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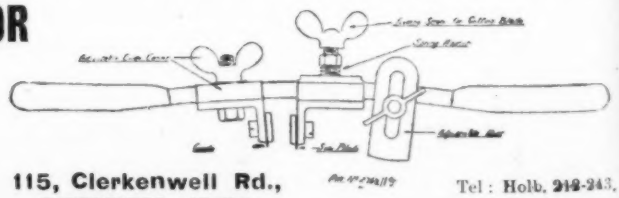

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The

Electrical Review

VOL. XCIV. MARCH 7, 1924. No. 2,415.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

Chairman: H. ALABASTER.

Technical Editor: A. H. ALLEN, M.I.E.E. *Joint Managing Directors:* G. H. ALABASTER. E. A. GATEHOUSE, M.I.E.E. A.M.INST.C.E. *Commercial Editor:* A. H. BRIDGE.

Manager and Secretary: E. S. MIDDLETON.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

Telegraphic Address: "AGEEKAY, CENT., LONDON," Code, A B C. Telephone Nos.: Central 8260 and 8261.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d.; Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

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Imperial Wireless Telegraphy.

THE report of the Imperial Wireless Telegraphy Committee, which commenced sitting on February 8th, was presented to the Postmaster-General on February 20th, and appeared in the columns of the daily Press on Friday last. The celerity with which the whole proceeding has been carried out almost takes one's breath away, and on this head Mr. Robert Donald and his Committee have won universal congratulations, to which they are undoubtedly entitled. Moreover, the report is no small effort; it comprises 48 pages and contains a large amount of general information on wireless matters relevant to the subject of reference. And it raises a number of issues, some of which are highly controversial.

The purpose of the Committee has avowedly been to put an end to the deadlock which has arisen between the Postmaster-General and the Marconi Company, as the outcome of nine months' negotiation—a most regrettable loss of time, which has aggravated the disadvantages under which this country labours in respect of radio-communication with the oversea Dominions. Ever since 1911, when negotiations commenced with regard to the Imperial service, political and commercial considerations have continuously spragged the wheels of progress, and have led to exasperating delays in a matter which from the first has been regarded on all hands as "urgent," so that the public has been disposed to say with Mercutio: "A plague on both your houses!" Undoubtedly, the time has come when further procrastination cannot be tolerated, and a decision must be made which will enable an Imperial wireless service to be inaugurated as quickly as possible; whether it be the most efficient from a technical point of view, or the most economical from a commercial point of view, can no longer be discussed—*we must have the service!*

For this reason we are not greatly concerned to dwell upon the respective merits of the parties whose squabbles have led to the situation before us; nor would we advance any argument or proposition tending to delay the institution of the service which is so anxiously awaited by the public not only of the Home country but also of the Dominions and Colonies. As the Committee says, the prospects of agreement were hopeless; that being so, a decision in favour of a State service was inevitable. However, acceptance of the inevitable does not necessarily imply that we welcome it, or that we believe it to be the best solution of the problem—when Alexander cut the Gordian knot with his sword, he did not untie it, he merely put an end to it.

We have always held, and we still hold, that the State cannot conduct a commercial enterprise with the same efficiency and economy as an *ad hoc* organisation formed on sound business lines, and working on the basis that it must make the business pay. The history of the Post Office Department proves that it is no exception to the rule, and we foresee that the British part of the Imperial service is likely to involve the State in heavy outlay, whilst it will labour under the added handicap of communicating with Dominion stations that are under independent management. It is undeniable that the Marconi Company, which will operate the oversea stations under its contracts with the Dominion Governments, would be in a much better position than the Post Office to organise the Imperial system on a paying basis. However, we must put up with the consequences of past errors of government which have brought us to the present position. A ray of hope shines out of paragraph 64 of the Report: Recognising that the Post Office as at present constituted is unfitted to cope with the complex problems that will face it, the Committee remarks that the Department "will be keenly criticised and will be judged largely by its business record"—an ominous but true statement—and recommends the adoption of "improved organisation so as to put the business on equality with a private corporation." In paragraph 68 it is added that "the business organisation should be remodelled" and "the services of the most capable administrative engineering and executive officers in all branches should be obtained under conditions which will attract them and retain their services." It is on the adoption of these recommendations that the success of the Imperial service in the hands of the Post Office wholly depends; the existing system, under which control is vested in a non-technical secretary and the authority of the engineers is restricted, is incapable of achieving the desired ends. As the Committee says, "delegation is necessary. The administrative head of the wireless and associated services should be able to act promptly in all matters of business, and the normal routine should be modified, to enable this to be done." Is it too much to hope that the result may be the reorganisation of the whole of the engineering department of the Post Office on sound commercial lines, and the abolition of the ridiculous practice under which the Postmaster-General is a politician, changing not only with every change of Government, but also with the frequent reshuffling of Ministerial appointments? That preposterous practice is largely to blame for the scandalous delays which have been inflicted upon the progress of Imperial wireless telegraphy.

We cannot close without some comments on the conduct of the affairs of the Marconi Company, the other party to the struggle which for 12 years it has carried on with the Post Office. That the company has legitimate claims to favourable consideration is unquestionable, on technical grounds; it has accomplished a vast amount of pioneering work, which is recognised in the Committee's report, and has rightfully occupied a leading position in the wireless world. We would gladly have seen it entrusted with the Imperial service, which it would have carried out efficiently, and free of cost to the State; and the Dominion Governments have demonstrated their confidence in the company by placing their sections of the Imperial system in its hands.

But the fact remains that apart from the technical aspect the management of the company's affairs has not always commanded popular approval. The policy of the company has been directed largely towards the multiplication of subsidiary concerns, the acquisition of concessions in various countries, and the cultivation of foreign interests and associations which give it rather an international than a national complexion. No doubt all these operations are perfectly legitimate, but they savour rather of finance than construction. Similarly, in connection with the Imperial service, the company has appeared to be more concerned to make a good bargain than to get on with the job. Frankly, if the Report of the Committee has given the company a slap in the face, we think it has no one but itself to blame, and that it will find few disposed to sympathise with it, outside financial circles. For ineptness it would be hard to beat the statement issued by Mr. Godfrey Isaacs last week-end, in which he enlarges upon the benefits of a new system "which is about to be put into actual working operation," and which "promises to revolutionise the entire practice of wireless telegraphy." It would be better to leave out altogether the question of "new systems" at a time when the installation of any system whatever is urgently called for. The time for action has come, and the knot has been cut.

International Conference on e.h.p. Lines.

Our readers will recollect that in our issues of December 7th to 28th, 1923, we gave a full and exclusive report, prepared by Mr. R. Borlase Matthews, of the proceedings at the recent meetings in Paris of the International Conference on E.H.P. Transmission Lines. In spite of the fact that the Conference was initiated two years ago, very little is known of its aims and objects in English-speaking countries, largely because the reports have been issued in French, and so far the English subscribers have not been sufficient in number to warrant the production of an English text.

In view of the great importance of the work of this International Conference, the Institution of Electrical Engineers has invited M. Tribot Laspière, the organising secretary, to come over and give an address at an "informal meeting" to be held at the Institution at 7 o'clock on Monday next, March 10th, when it is hoped there will be a large attendance.

The work of this Conference is not only of general interest to power engineers; it is also of interest from the point of view of standardisation, for it has been fully recognised as of material assistance to the I.E.C. in preparing the ground and sending forward proposals which can be studied by an Advisory Committee, with a view of being ultimately promulgated as recommendations of the International Electrotechnical Commission. We understand that in order that an English text of the report of the recent conference may be available, a minimum of 1,200 subscriptions are required at 100 fr. each. It is to be hoped that electrical engineers up and down the country will make a point of being at this meeting, not only to welcome our French friends—it is understood that M. Legouez, the president of the Union des Syndicats de l'Electricité, will be at the meeting—but also that they may learn something of the important work already accomplished and the future importance of this international conference. Judging by the printed report of the previous conference, which we review elsewhere in this issue, the proceedings of the meeting of November last will be well worth the price asked for them.

The Ideal Home Exhibition.

As recorded on another page, the eighth Ideal Home Exhibition was opened last week, and once again the electrical industry is found wanting.

Many of the leading electrical firms of this country apparently consider the show too trivial for their attentions—or perhaps too "popular"; some seem to content themselves with presenting an agglomeration of appliances which suggest a nightmare in nickel finish; others fly to the other extreme; but very few strike the happy medium of few but effective exhibits with common-sense demonstrations. It is not very encouraging to find the most effective electrical display (and that not inordinately convincing) arranged by a "lay" firm (Barker's), but such is the case. It is to be regretted that the British Electrical Development Association could not find it possible to take a hand in the exhibition; its influence and experience in co-ordinating the efforts of individual exhibitors would have been invaluable. What is needed, to our mind, is a co-operative electrical display such as we are hoping to see at Wembley soon. It may be that the British Empire Exhibition is providing more than sufficient work for the E.D.A., and if this is the case we will hope for a proper electrical display at the next Ideal Home Exhibition.

Probably public interest centres chiefly in the houses which have been erected at Olympia, and a house is the correct building in which to demonstrate the benefits of electricity. Advantage has been taken of this to show the efficiency of electric lighting—alone. We feel that we cannot altogether blame electrical people for this, the arrangements are, of course, in the hands of the erectors of the buildings, but we would suggest that a list of these erectors should be made by electrical contractors and others for use prior to the next exhibition. This lack of electrical methods in such model dwellings has left us with the conviction that the Ideal Home Exhibition is not an exhibition of ideal homes.

Trade with Russia and Russian Debts.

The Federation of British Industries has taken an appropriate, and at the same time, very necessary step in approaching the Government in regard to the commercial side of the question raised through the acknowledgment *de jure* of the Soviet Government, with particular reference to debts due by Russia, and the question of commercial treaties. If there is to be any feeling of confidence in the *bona fides* of the Soviet Government the Federation suggests that the acceptance of the following six points is absolutely essential: (1) The recognition by the Soviet Government of its liability for all debts contracted by previous Russian Governments, either with the British Government or with British subjects; (2) suitable provision to be made for the payment of interest and arrears of interest on these debts; (3) an undertaking to institute satisfactory arrangements for the eventual repayment of the principal of these debts; (4) an explicit recognition of liability to pay compensation in full to those British subjects who have suffered injury to their persons or property through the events which followed the revolution; (5) the acceptance of suitable arrangements for assessing the amount of this compensation, and for guaranteeing its prompt payment; and (6) an undertaking to agree to the establishment of a clearing-house system to deal with debts and interest thereon owing to British subjects by Russian subjects. It is recognised by the Federation that in present circumstances it would be impossible for the suggested undertakings to be fulfilled immediately, and that it would be reasonable to consider the grant of a moratorium in the matter of some of the claims; but it is urged that guarantees should be insisted upon that would hold out some promise for the due observance of the undertakings entered into. The Federation also raises the question of commercial treaties and urges that the British Government should adopt measures to ensure that British interests should secure treatment not less favourable than that existing before the advent of the Soviet Government, and also equal treatment with other nations. It is also desired to learn what attitude the Government intends to assume in relation to obtaining perfect freedom for the legitimate activities of British traders in Russia, which were secured by previous treaties, but which are in conflict with certain of the principles of the Soviet Government.

The forthcoming conference between representatives of Great Britain and of Soviet Russia will doubtless have a decisive effect upon the future of trading between the two countries. If the Soviet Government acknowledges the debts of former Russian Governments, and gives essential guarantees, all may be well. But, assuming that the debts are admitted, the fact cannot be overlooked that there is another side to the question—the Russian. It has been known for a long time past from speeches delivered by representatives of the Soviet authorities that the latter are prepared to acknowledge the debts due to England provided that England will "acknowledge her debts to Russia." In other words, the Soviet authorities have a contra account for damages and losses which are alleged to have been caused through the direct and indirect intervention of Great Britain in Russia; and the amount of this contra account is said to exceed the amount of the united claims of Great Britain against Soviet Russia so that, according to the Russian version, England owes money to Russia on the balance. This may seem a fairy tale, but we leave it to the forthcoming conference to show that the question of a contra account is without any foundation. Certainly the cardinal problem of the conference lies in the matter of the past debts of Russia because, failing a settlement of this matter, what prospect exists that, if credits were granted, any future debts would be honoured by the same authorities? Government authorities who repudiate old debts one day may also disregard new liabilities on another. Until this main question is satisfactorily settled it does not seem that a treaty of commerce would inspire any confidence in the future of trading with Soviet Russia, except on a cash basis or by bargaining as at the present time.

Chartered Electrical Engineers.

Having obtained a Royal Charter, the Institution of Electrical Engineers has now gone a step further; encouraged by the success of the senior Institution, it has sought authority for its Corporate Members to describe themselves as "Chartered Electrical Engineers," and has altered its By-laws with that end in view. The Members are to be congratulated upon this important action on the part of the Council, which will enable them to gain the full benefit of their membership of a Chartered Institution—which, by the way, has now over 11,500 names on its roll of members, and is in a fair way to top the 12,000 before the session ends.

Having done so much to raise the status of electrical engineers, the Council may be pleased to know of a further opportunity for action on their behalf. We notice that in one of the Bills relating to the supply of electricity to London, shortly to come before Parliament, it is specified that engineers who are appointed to serve on a Technical Committee shall be members of the Institution of Civil Engineers. As some of the most able and experienced engineers concerned are members of the I.E.E., but not of the I.C.E., they would be barred out if this pernicious clause were allowed to remain in the Act, assuming that the measure attained to that dignity. The Council, we are sure, will need no exhortation to induce it to take the most vigorous action in the matter, and to secure the immediate withdrawal of what can only be regarded as a deliberate insult flung in the face of the Institution within whose own particular province the subject of the Bill in included.

D

Single-phase Variable-Speed Motors.

By N. PENSABENE PEREZ.

The single-phase shunt-type commutator motor (Electrical Review, May 18th, 1923), in addition to its ability to start against heavy loads whilst taking a small current from the line and to work at unity power-factor on load and with a leading current at fractional loads, lends itself to easy and economical speed control without impairing its shunt characteristics along all its speed range. This feature recommends this motor in all cases where a moderate speed range is required and no great variation in speed is permissible, with varying loads, as when driving printing presses, machine tools, fans, &c., and in special cases of compressor or pump drives.

The speed range permissible is only limited by sparking troubles, which, of course, increase with the size of the motor, its frequency, and its synchronous speed.

The motor when running out of its synchronous speed has to deal with the commutation difficulties found on d.c. non-interpole motors on account of the reversal of current in the coils undergoing commutation, and also with the commutation troubles peculiar to its nature, and due to the difference of the transformer and rotation e.m.f.'s in these coils which are balanced at synchronism. As the motor is provided with two sets of main and field brushes, it is natural to ask which are the brushes most affected by sparking?

Leaving aside the sparking due to reactance voltage, which follows the well-known laws found in d.c. practice, what can be termed the "inductive sparking" depends on the method adopted for the speed control.

Thus it is interesting to note that if the speed is varied by shunt control the sparking appears only under the main brushes, while complete compensation at all speeds is maintained in the coils short-circuited by the field brushes.

The reverse result is reached if the speed variation is obtained by voltage control, in which case no inductive sparking takes place at the main brushes.

As the main brushes carry the larger current, it would therefore appear that the latter control is preferable to the former, and this would be so were it not for other adverse factors which we need not discuss in these few notes.

As for d.c. motors, the shunt control is characterised by the field flux decreasing above and increasing below synchronism; within the capacity of its winding, therefore, the motor can only transmit constant power at all speeds.

In the case of voltage control by means of a separate transformer across the main brushes, the motor flux increases above synchronism and decreases below it; thus within the capacity of its windings the motor transmits greater power above and smaller power below synchronism, transference of motoring or generating energy taking place through the regulating transformer.

In the following the shunt method of speed control will be discussed and the above remarks made clear by reference to the general theory of the motor.

Taking the case of a two-pole armature having one set of brushes (main brushes) in the axis of the primary winding, and another set of brushes (field brushes) at 90 degrees to the former, when the motor is up to speed there must be a flux N_x inducing an e.m.f. $E_x = KN_x f$ by transformer action in the main brushes and an e.m.f. $e_y = KN_x f_o$ in the field brushes by rotation, f, f_o being the supply and rotation frequencies. This flux apart from leakage and primary resistance must be constant, because it has to balance the voltage applied on the primary.

The e.m.f. e_y by acting in the field brushes' axis produces a current and a flux N_y in space and time quadrature to N_x. If an inductance or capacitance is put in series with these brushes and we call s its ratio (positive for inductance and negative for capacitance) to the armature inductance, we must have, neglecting resistances, $e_y = E_y + sE_y$, where $E_y = kN_y f$ is the armature e.m.f. induced by transformer action by the flux N_y. It is therefore—

$$f_o N_x = (1 + s) f N_y \text{ or } N_x/N_y = (1 + s) f/f_o \quad \ldots (1)$$

The flux N_y produces in the main brushes a rotation e.m.f. $e_x = k f_o N_y$, and if we neglect resistance it must be—

$$E_x = e_x \text{ or } N_x/N_y = f_o/f \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

Now if n is the number of armature turns, and s the number of commutator bars, the voltage induced in them is evidently, expressing fluxes in megalines and by reference to (1) and (2), in the main brushes—

$4{\cdot}4\, n/s.\ 1/100.\ (N_x f_o - N_y f) = 4{\cdot}4\, n/s.\ f/100.\ N_x (f_o/f - f/f_o)$,

and in the field brushes—

$$4{\cdot}4\, n/s.\ 1/100.\ (N_y f_o - N_x f) = 0.$$

Introducing the value of $E = 1{\cdot}42\, f N_n\, n/100$, the voltage induced in the main brushes is given by—

$$3{\cdot}1\, E_x/s \times (f_o/f - f/f_o).$$

This relation is substantially correct, the neglect of the armature resistance having little effect upon it.

Assuming the minimum permissible voltage between bars to be about 3 volts, we can say in general that the speed range of a motor is limited by the relation—

$$\pm\, E_x/s \times (f_o/f - f/f_o) \leq 1.^*$$

This motor is generally started as a series type, and if full-load torque is required at starting, the field flux should be about equal to the normal flux. In this case the induced voltage at starting would be $3{\cdot}1\, E_x/s$, so that if we limit this voltage to 3 volts, we have $E_x/s \leq 1$, and the above formula becomes $\pm (f_o/f - f/f_o) \leq 1$, which leads to the following speed range limitations: $\cdot 63\, f < f_o < 1{\cdot}63\, f$.

Owing to the additional reactance voltage, it is hardly safe to reach the above limits for motors above 5 b.h.p.

A remarkable feature of this method of speed control is the possibility of keeping the power factor near unity at full load all along the speed range.

The efficiency of the motor has a tendency to drop when running below synchronism, and this is due mainly to the additional iron loss, which can be approximately reckoned as follows: —

Near synchronism, as we have seen, the two fluxes are equal and in space and time quadrature; therefore a resultant revolving field is produced and no iron losses are present in the armature.

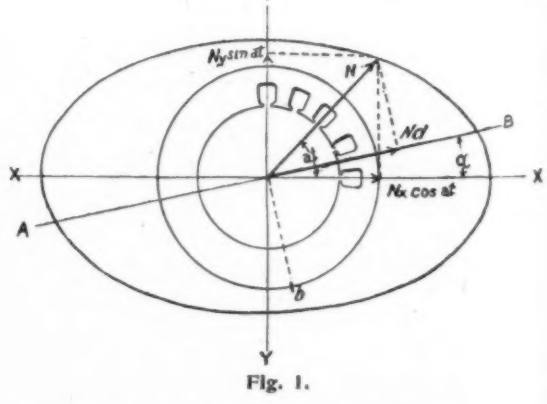


Fig. 1.

Outside synchronism an elliptical revolving field N is produced which can be expressed by—

$$N^2 = (N_x \cos at)^2 + (N_y \sin at)^2.$$

The value of this flux at any instant, along a plane making an angle α with the plane in which the main flux is acting, is therefore $N \cos (at - \alpha)$ and its maximum value is given by—

$$N_d^2 = N_x^2 (\cos^2 \alpha + f_o^2/f^2 \sin^2 \phi) \text{ or}$$
$$N_d = N_x \sqrt{1 - (1 - f_o^2/f^2) \sin^2 \alpha}.$$

*The signs refer to speeds above or below synchronism respectively.

This represents the maximum flux passing in the slot section contained in the plane a and in the section b at 90 degrees, as shown in fig. 1.

The total iron losses in the stator are therefore—

$$W_s = P_H\, 1/2\,\pi \cdot \int_o^{2\pi} \left(\sqrt{1-(1-f_o^2/f^2)\sin^2 a}\right)^{1.6} da$$
$$+ P_E\, 1/2\,\pi \cdot \int_o^{2\pi} \left(\sqrt{1-(1-f_o^2/f^2)\sin^2 a}\right)^2 da,$$

where P_H and P_E are the hysteresis and eddy-current losses due to the flux N_x at the frequency f.

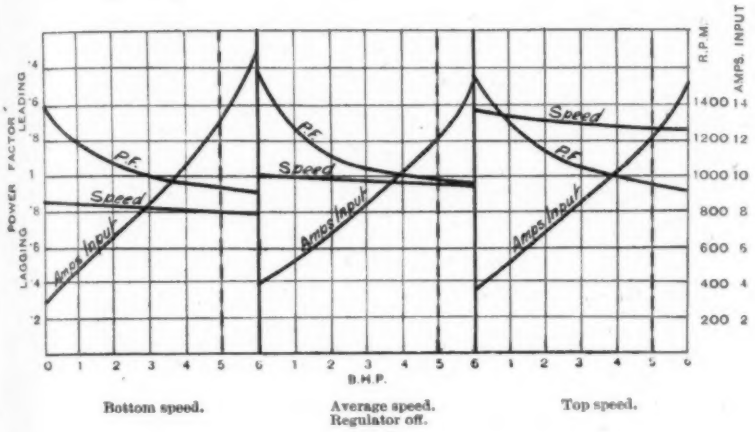
The second integral is readily found, being equal to :—

$$2\pi - \pi(1-f_o^2/f^2) = \pi(1+f_o^2/f^2).$$

positive and ϕ_H, ϕ_E are the hysteresis and eddy-current losses in the armature due to the flux N_x at the supply frequency.

As an example of the effect of speed variation on the power factor, iron loss, efficiency, &c., the curves referring to a 5-b.h.p., 400-volt, 50-cycle, single-phase 6-pole motor made by the Electro-Dynamic Construction Co., Ltd., are given in fig. 2. and fig. 3. Within the limits of the speeds given, the commutation is satisfactory.

The control adopted is of a very simple character, and the motor can be started on any position of the speed controller, the starting torque of course decreasing for speeds above and increasing for speeds below synchronism.



Bottom speed. Average speed. Regulator off. Top speed.

Fig. 2.

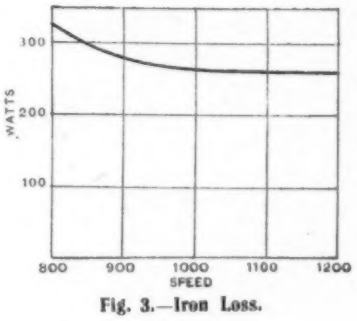


Fig. 3.—Iron Loss.

To find the first integral we can expand the expression in its exponential series in the assumption of $\pm(1-f^2/f_o^2) < 1$ for any speed above or below synchronism. Thus—

$$[1-(1-f_o^2/f^2)\sin^2 a]^{.8} = 1 - \cdot 8\,(1-f_o^2/f^2)\sin^2 a - \cdot 48\,(1-f_o^2/f^2)\sin^4 a \ldots.$$

and neglecting the 3rd and following terms, the 1st integral is given by : $2\pi - \cdot 8\,\pi(1-f_o^2/f^2) = \pi(1\cdot 2 + \cdot 8\, f_o^2/f^2)$. Finally therefore : $W_s = P_H(\cdot 6 + \cdot 4\, f_o^2/f^2) + P_E).5 + \cdot 5\, f_o^2/f^2)$. Similarly the armature losses are—

$$W_a = \phi_H/f \times (f_o - f)[\cdot 6 + \cdot 4\, f_o^2/f^2] + \phi_E/f \times (f_o - f)[\cdot 5 + \cdot 5\, f_o^2/f^2],$$

where the slip frequency $f_o - f$ must be taken always

This motor is started by means of a single automatic resistance starter, but this, when allowed by the supply authorities, can be dispensed with and replaced by a throw-over single-pole switch. Finally, it may be noted that if the starting torque required is less than half the full running torque, the motor can be started by a single-pole switch direct from the line, no starting and running positions being required.

The Electro-Dynamic Construction Co., Ltd., is now placing on the market single and polyphase machines of the variable-speed type embodying an improved method of speed control, which will allow a wider speed range to be obtained.

Boiler-Room Practice.

By JOHN BRUCE, A.M.I.E.E.

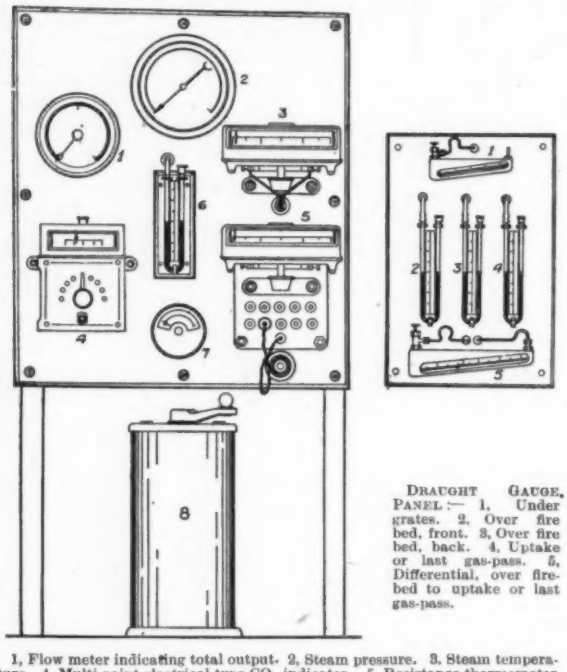
(*Concluded from page* 325.)

The installation of a CO_2, or preferably CO_2, CO, &c., electrical type of recorder or indicator, permits a ready solution of the problem of gas analysis in the case of the small plant, since only one recorder or indicator is required, provided with a multi-way switch by means of which it can be connected to any one of the element cells in the gas pass of each boiler unit. As a general rule gas analysing and recording apparatus is installed as a guide, to the operators, for the maintenance of efficient combustion conditions, and also for the approximate determination of heat losses. Therefore, the best point from which the gas sample should be drawn is where the gases leave the last of the heating surfaces.

Another point very often neglected is ensuring that the sample of gas handled by the instrument is representative of all the gas passing that particular section of the gas passage at which the sampling apparatus is inserted. Before the instrument is connected up, an exhaustive study must be made of the flow of gas at the particular section decided upon and careful note made of the gas velocities over the whole cross-section, and their tendency to bank to one side, &c., with different rates of combustion and boiler rating. Careful installation of the gas sampling apparatus will be amply repaid by the accuracy of the results obtained, and it must be borne in mind that it is not sufficient to simply push a perforated pipe into the gas passage and leave the rest to chance. A six or eight-legged spider connected to the sampling pipe, which should reach the centre point of the gas passage, ensures a representative sample of gas being delivered to the instrument. A serious objection to CO_2 apparatus is the trouble due to choking of the gas line to the instrument with what appears to be a sulphate of the metal of which the pipe is composed, and there is room on the part of boiler-room scientific instrument makers for considerable improvement in the filtering and drying of the gas sample as near as possible to the point at which the sample is drawn, thus preventing the deposition of sulphurous and sulphuric acid in the pipe line and instrument.

Instruments or thermometers for the measurement of flue gas temperatures are also liable to be carelessly in-

stalled. The accurate measurement of gas temperatures is an art which calls for a high degree of skill and patient investigation. Whether thermo-couples, resistance thermometers, or ordinary mercurial thermometers are to be used for flue gas temperature measurements, the same investigations must be made concerning gas flow, &c., as are necessary when deciding on gas sampling points for CO_2 apparatus. Further problems present themselves in connection with "radiation" effects, due to the measuring instrument and gases, the temperature of which is being measured, being surrounded by bodies at, possibly, widely different temperatures. It has been proved that the smaller the part of the temperature measuring apparatus exposed to the gases, and the smaller the temperature difference in the neighbourhood, the smaller will be the error due to the effect of "radiation"; therefore, since thermo-couples can be made very small, and at the same time retain a robustness of construction, they are to be preferred for ordinary every-day work, due regard being given when installed that they register the temperature of a representative sample of the gas. Small thermo-couples can be "home-made" for a very moderate expenditure.



Draught Gauge, Panel:— 1, Under grates. 2, Over fire bed, front. 3, Over fire bed, back. 4, Uptake or last gas-pass. 5, Differential, over fire-bed to uptake or last gas-pass.

1, Flow meter indicating total output. 2, Steam pressure. 3, Steam temperature. 4, Multi-point electrical type CO_2 indicator. 5, Resistance-thermometer and plug-board for flue-gas and feed-water temperatures. 6, Draught in main flue at stack or fan. 7, Induced fan motor amperes. 8, Induced fan motor speed control.

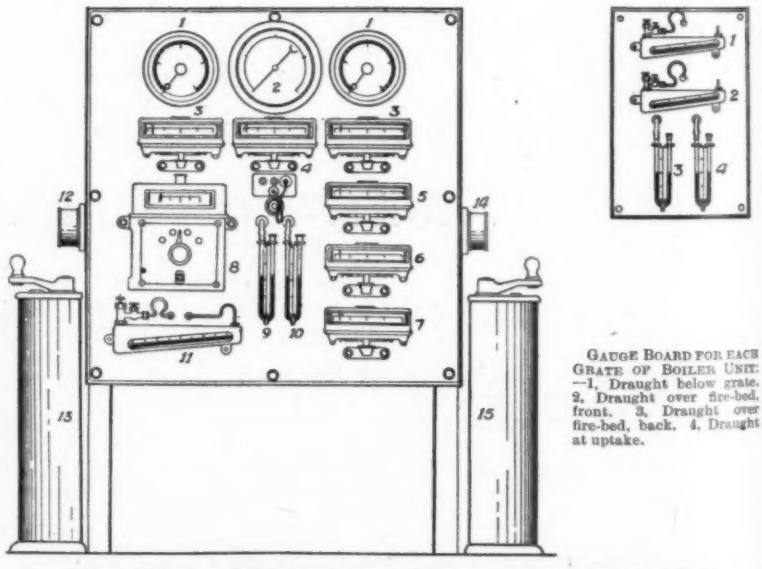
Fig. 2.—Instrument Panel for Small Plant of Six Boilers, operated on one Stack with Induced Draught.

Draught gauges, though not possessing the impressive appearance of other boiler-room instruments, are as important as any of the more expensive equipment, and it is deplorable to see the manner in which they are often installed and allowed to fall into disuse. One finds them stuck in all sorts of out of the way, hole and corner places, with the result that the indications of these instruments are seldom, if ever, seen. It should be borne in mind by those in charge, that if a boiler-room crew is to produce better results by the aid of instruments, such instruments must be installed in a position where they will be readily observable. For this reason they should, as far as possible, be grouped in the order of their circuits, and mounted on an instrument board in the firing aisle. In the case of the small plant, where each individual boiler may not be equipped with its own set of instruments, the principal apparatus, such as flow meters indicating the total output of steam, CO_2, &c., indicator or recorder, flue gas and other pyrometers, should be mounted on one control panel as shown in fig. 2, draught gauges, &c., being mounted on a small panel at the front of the boiler to which they refer.

In the larger generating stations, an attempt is now being made to centralise boiler-room control, the necessary indicating and recording instruments, and in cases also air and fuel controls, being installed in a control room, possibly some distance from, and out of sight of, the boiler room. In the writer's opinion, the best method is to equip each boiler unit with its own instrument and control panel, erected in a position conveniently adjacent to the unit to which the instruments refer. In such a position the indications and records are under the continual observation of the combustion engineer and, further, instrument indications and actual furnace conditions are readily comparable. In fig. 3 is shown a typical instrument and control panel for a large boiler unit.

It has been previously stated that the trained combustion engineer will be able to operate the plant in his charge and get the best results therefrom, entirely from the instrument indications, but if an accurate check is to be kept on the sources of loss, thus entailing a knowledge of the magnitude of such losses, a record of the performance of the plant is necessary. The losses in a boiler plant usually expressed as items of a heat balance statement in boiler test reports are as a rule set out in the form reported below:—

	B.th.u.	Per Cent.
Loss in dry flue gases		
Loss due to moisture in coal		
Loss due to moisture from combustion of hydrogen		
Loss due to moisture in air		
Loss due to carbon-monoxide		
Loss due to combustible in ash		
Loss due to "radiation"		
Losses unaccounted for		



Gauge Board for each Grate of Boiler Unit:—1, Draught below grate. 2, Draught over fire-bed, front. 3, Draught over fire-bed, back. 4, Draught at uptake.

1, Steam flow meters. 2, Steam pressure gauge. 3, Steam temperature pyrometers. 4, Resistance thermometer, feed-water temperature at inlet and outlet of economiser. 5, Flue-gas pyrometer, temperature at uptake. 6, Flue-gas pyrometer, temperature at entry to economiser. 7, Flue-gas pyrometer, temperature at exit of economiser. 8, CO_2 indicator, two-point, electrical type, element cells at uptake and exit of economiser. 9, Air-pressure in forced-draught duct. 10, Draught at induced-draught fan or stack. 11, Differential gauge over fire-beds to uptake. 12, Forced-draught fan motor ammeter. 13, Forced-draught fan motor speed control. 14, Induced-draught fan motor ammeter. 15, Induced-draught fan motor speed control.

Fig. 3.—Instrument and Control Panel for Large Boiler Unit.

Obviously, it is commercially impossible to accurately determine the separate value of all these losses at the end of each day's operation, and when instituting a log sheet, or other system of record keeping in the boiler room, it must be remembered that prolixity does not

necessarily mean increased ease of analysis of operating results. The information obtainable from the boiler-room log-sheet will depend upon the extent of the instrument equipment, and when drafting a system for the tabulation of operating records, the criterion to be aimed at is that it should be possible, not only to evaluate the various losses, but also definitely locate the sources of such losses, so that means can be immediately instituted for their reduction.

Broadly speaking, the criterion of boiler-room plant performance is the cost of evaporating water to steam at a certain pressure and temperature, the value, for comparative purposes, being usually expressed as the cost of evaporating a definite weight of water from and at 212 deg. F. per 10,000 B.th.u.'s in the coal. If this value is determined daily it provides comparative figures from which the performance of the plant can be fairly judged.

The daily determination of the thermal efficiency of the boiler plant, while certainly providing interesting technical information, does not give a ready means of separating and localising the various losses nor does it give information as to the cost of producing steam. At any rate, if efficiency figures are desired it is a simple matter to estimate their value from the factors equating the cost of evaporation.

"Radiation" losses call for little comment, except that in many cases, and industrial plant in particular, the prodigal waste of coal from this source must reach an alarming figure. The "radiation" loss is one that is not greatly influenced by the operating staff, and it is a simple matter to reduce and maintain this loss at a minimum by careful attention to furnace, boiler, and steam and feed-water pipe-line heat insulation.

The loss due to unconsumed carbon carried over in the ash can reach very serious proportions if not kept under continual surveillance, and this item in the operating records should be determined daily. This is accomplished by carefully sampling the ashes discharged and estimating the unconsumed percentage contained in a given weight. The determination does not involve the use of elaborate or expensive laboratory equipment.

By far the greatest loss occurring in a boiler plant is that by way of the gases discharged to the stack. Provided the plant is equipped with apparatus for the indication or recording of flue gas temperatures, CO_2, &c., the combustion engineer will be able, while the plant is in operation, to maintain the stack loss, according to the instrument indications, at or near the state of affairs generally considered normal, and from the records of gas temperature and CO_2 he will also be able to estimate a figure, which may be approximately comparative, for the value of the heat loss in the flue gases. The actual loss, to be determined with any degree of accuracy, requires in addition to gas temperature, a complete analysis of the flue gases, and an ultimate analysis of the coal consumed.

Neglecting the loss due to moisture from the combustion of the hydrogen content of the fuel, and the loss due to moisture in the coal and air, the loss due to heat carried away in the dry flue gases can be considered as being made up of three components:—

(1) The loss in the gases resulting from theoretical combustion of the coal consumed, which cannot be reduced.

(2) The loss due to excess air drawn through the fuel bed, which can be reduced to a definite minimum value, governed by the class of coal consumed and the efficiency of the furnace and combustion chamber air mixing arrangements.

(3) The loss due to the percentage of the total excess of air caused by leakage and infiltration through the boiler and economiser settings. This component should be almost entirely reducible.

The usual heat balance, and the generally accepted formulæ for the calculation of the heat loss in the dry flue gases, do not separate or give the value of the components outlined above, and this loss can only be kept at a minimum by the systematic investigation of flue gas conditions from furnace to stack.

The Proposed Padiham Generating Station.

Electricity Commissioners' Inquiry at Burnley.

Sir Harry Haward and Mr. A. Page, members of the Electricity Commission, with Mr. D. S. Cumberlege (clerk) held an inquiry at Burnley, on February 27th, into an application by Burnley Corporation and the Lancashire Electric Power Co. to erect generating stations at Simonstone and Padiham respectively. Mr. E. Jones, K.C., with Mr. Roward Harker, represented the Corporation; Mr. W. Henderson, K.C., with Mr. A. Tyler, represented the Power Co. Representatives were present from Accrington, Clitheroe, and Padiham Councils, the Ribble Joint Committee and Clitheroe Estate Co.

Mr. HENDERSON (for the Power Co.) outlined the history of its development, and said the Company's output in 1923 increased to 88.7 million kWh. The idea was to extend gradually towards the north. When the war ended, this policy was resumed. The line was carried as far as Chorley, across the boundary of South East Lancashire Electricity District. At the Preston inquiry a year ago, it was announced that the Company desired to build a station at Padiham. As a result, a scheme had been drawn up for a Joint Advisory Board for the district. In Padiham, Clitheroe, and intervening districts, no one but the Company was authorised to supply.

Burnley's application was for a temporary station. Padiham Council had passed a resolution favourable to the Company's application, and if it got the station, Padiham Council was prepared to become a consumer. There were, however, rival applications for the Padiham order. The position was that the Company could go into the area. Padiham was willing to become a small power user by buying in bulk and the Company would deal with the textile load just as it had done in many other parts of Lancashire. The control of generation was vital to the Company. The Company's site covered about forty-four acres, and it was proposed to generate and transmit at from 10,000 to 11,000 volts. The initial cost would be £249,720, after the first extension £353,720, and the final cost £690,150.

Mr. C. D. TAITE (the Company's engineer and manager), the first witness, said that at one stage the Company made a contract at a low figure to show what could be done in the spinning mill with electrical energy. As a result it got orders and to-day had no difficulty with authorities which at first held aloof. In Burnley, the Corporation had hardly touched the fringe of the textile load, which amounted to about 33,000 h.p. The Company proposed, if the application succeeded, to lay a main to Clitheroe and, if necessary, supply Church, Oswaldtwistle, Rishton, and Great Harwood. It would work in conjunction with the authorities and effect economies.

The inquiry was resumed on February 28th, when Mr. Taite continued his evidence, being examined for over two hours by Mr. Tyldesley Jones.

He said Clitheroe and Padiham had industries which could take supplies. They had arranged to supply Padiham in bulk, but he was not willing to disclose the terms. He was prepared to hand them to the Commissioners. The Power Company had selected a site, and there would be no difficulty in erecting a dam. There would not be any interference with the flow of the river. He believed they would get a big bulk supply, and the Company was willing to risk it.

At the close of Mr. Taite's evidence, the Chairman asked: "Do you take up the position that if you cannot generate as well as distribute you will not develop?"

Mr. TAITE: "That is the position that all power companies take up. We object to existing as mere middlemen for the distribution of energy."

The CHAIRMAN: "That seems to strike at the principle of the Act."

Mr. TAITE: "We have struggled against it and got amendments to the 1922 Act."

Questioned by counsel, Mr. Taite said the Company had already proved that it could work a station more cheaply than any authority in South East Lancashire, where they were more advanced than was the case in the East Lancashire district.

Dr. PARSHALL (a director of the Company) spoke of the financial position of the concern, the share capital of which, he said, stood at £700,000.

Outlining the case for the Burnley Corporation, Mr. Tyldesley Jones pointed out that the Company had frankly stated that if its application was refused, it would not carry out its statutory obligations.

Mr. J. A. Robertson (consulting engineer, of Manchester), who was responsible for the scheme for erecting a station outside Padiham, said that the potential load in Burnley for textile purposes was 38,242 h.p. In addition there was a potential load for other purposes of 20,000 h.p., making a total of 58,000, equivalent to 43,500 kW. Preston Corporation had received applications for 5,000 kW from prospective power users, whilst in Blackburn the output had increased by over 100 per cent. in the last 2¼ years.

Mr. H. Nuttall (chairman of Burnley Electricity Committee) said the capacity of the town's present station as regarded plant was about 8,000 kW. The maximum demand last year was 3,750 kW, and they were advised that the existing station ought not to be extended. There was in the borough a very big demand for prospective power supply which the Corporation alone could meet. There had been a canvass of textile and other manufacturers in the district and satisfactory replies had, in many cases, been received. Their success in meeting those requirements would depend on the erection of a new station. They had made an offer to supply Padiham immediately with power if they could get an order from that district. That was an offer to supply them from the existing station. In the event of a new station being permitted he would, in about 2¼ years, be prepared to reconsider prices. They were prepared to supply the Lancashire Electric Power Co., if they received consent to the erection of the proposed new station, at the cost of production, plus 5 per cent.

Mr. Henderson (for the Power Co.), said Burnley made a net profit last year of £18,000. Could Burnley Electricity Committee not run the undertaking and show a profit by taking power in bulk from the Company at cost, plus 5 per cent.?

Mr. Nuttall: We have never considered that. We take this as a legitimate extension of the Burnley undertaking. Mr. Nuttall agreed that, if approved, this would be Burnley's link with neighbouring corporations and one condition was that they should have transformers at Burnley to take supplies from Accrington and other places. Burnley was to bear part of the cost of putting down the necessary mains. In carrying out the scheme there would be no need for a supply from Burnley until after 1926, when Burnley could begin to think of a receiving station. They had already negotiated with Accrington, and had got their terms. Burnley had not accepted them, and negotiations were now in suspense. They had no objection to bulk supplies from Accrington if they could get them at favourable prices.

Representatives of Simonstone Garden City area objected to the proposed station there on the ground that it would be detrimental to the property of the district.

Mr. J. A. Robertson (consulting engineer) said that whilst Preston and Burnley had similar populations, he looked for a greater development at Preston because of the Borough's more favourable situation, and because of the great industrial load to the south of Preston which, up to the present, had been untapped.

Mr. A. Collins (financial adviser to Burnley Corporation), said the Corporation would be able to borrow the requisite money for the station at a rate of 4¼ per cent.

The Chairman said Burnley's outstanding debt was £1,822,000, and the rateable value was £470,000. Did witness not consider the relation between the two rather serious?

Mr. Collins said one half was represented by housing for which the Corporation was only responsible to the extent of a 1d. rate, with water, lighting, &c. If housing was excluded, Burnley's debt was only about half a million pounds.

Padiham District Council supported the application of the Power Co. because it was also stated that land for the erection of villas could not be proceeded with if the Burnley scheme to build a station at Simonstone was proceeded with.

On Saturday the Commissioners visited the respective sites, and then announced that they would give their decision in due course.

North Wales and South Cheshire Joint Electricity Authority.

Progress of Work.

The North Wales and South Cheshire Joint Electricity Authority met at Llandudno on February 26th, Mr. A. Hewitt, the chairman of the Authority, presiding, supported by the vice-chairman, Col. F. A. Cortez Leigh.

The clerk, Mr. A. Connolly, read a declaration signed by the secretary and the solicitor of the Electricity Commission of the appointment of the representatives of the counties of Cheshire, Denbigh, Montgomery, and Shropshire, and reported that the deed of transfer between the Authority and the North Wales Power Co. had been duly executed. It was announced that the Treasury guarantee of the additional capital of the Power Co. had been increased from £1,600,000 to £1,700,000. A letter was read from the Commissioners stating that the application of the Cambrian Electrical Supply Co. for an Order authorising the extension of its plant at Aberystwyth had been granted. The voluntary contributions which the county councils and other bodies had been asked to subscribe, on an agreed apportionment, towards the expenses incurred by the Joint Authority had been received, with one exception which was expected, and the clerk reported that he had been instructed to serve precepts upon the electricity undertakers in the district for the payment of the balance in accordance with an apportionment based upon the quantity of electricity sold.

A report upon the progress of the work for the supply of electricity in the area was received from Mr. H. J. Jack, managing director of the North Wales Power Co. The transmission lines constructed were the following:—Dolgarrog to Plas Madoc (1,000 volts); Colwyn Bay to Llandudno, Llandudno to Conway, and Dolgarrog to Llanbedr (all 6,600 volts); Llandudno Junction to Conway (cable); Colwyn Bay to Llandudno Junction; Penmaenmawr to Conway; Penrhyn Quarries to Bangor; Colwyn Bay to Llanddulas; Llanddulas to Rhuddlan; and Dolgarrog to Bryngwenith (all 35,000 volts). The lines in course of erection (35,000 volts) were: Waenfawr to Carnarvon; Bangor to Carnarvon; Rhuddlan to Holywell; and Holywell to Hawarden. Surveys had been completed for a number of lines, including two loops from Hawarden to Wrexham, and lines to Portmadoc, Pwllheli, Criccieth, Tremadoc, Denbigh, Runcorn, Crewe, Ellesmere Port, Barmouth, Harlech, Maentwrog, and Tremadoc. The lines already constructed amount to 40 route miles, including 6¾ miles of underground cable; those under construction amounted to 30 route miles, and those surveyed to an additional 140 miles. Apart from the men engaged upon this work, the company had a staff continually engaged in obtaining wayleaves from owners and tenants of the land proposed to be crossed by the lines. This was very slow and tedious work. There were powers which, in certain circumstances, could be exercised to allow the company to proceed over an owner's land in face of his opposition, but the company had done, and would continue to do, anything in its power to meet the reasonable wishes of the owners and tenants before having recourse to compulsory measures, and to cultivate among the people whose land the transmission lines crossed a spirit of friendliness.

The scheme for the new dam at Maentwrog was nearing completion. In the immediate future the Power Co. would proceed with the erection of the lines from Runcorn to Crewe and Crewe to Wrexham and loop lines from Wrexham to Hawarden. This would enable the eastern part of the district to obtain a supply from two sources so that it would be adequately safeguarded against breakdown until such time as the 66,000-volt lines from Maentwrog and Dolgarrog were able to take their share of the load. Lines would also be constructed from Penmaenmawr to Bangor and from the Marconi station to the company's power station at Cwm Dyli, thus providing additional safeguards to the whole of the towns being supplied by the company in the western area. So soon as the wayleaves had been settled, a 6,600-volt distribution line would be constructed from Rhuddlan to Rhyl, Prestatyn, Point of Ayr, Mostyn, Holywell, Flint, and Connah's Quay and Hawarden, thus enabling the whole of the Denbigh and Flint coasts to avail themselves of the company's power.

In addition to the work which was being carried out by the Power Co., the associated Aluminium Corporation, Ltd., was constructing a new low-level dam, which was very well advanced in spite of the abnormally bad weather, and would, it was anticipated, be complete in about two months' time. The whole of the track of the 6 ft. and 4 ft. 6 in. diameter pipe lines was complete, and a portion of the former was already laid, and the 4 ft. 6 in. pipes were commencing to arrive. The new power house and tail race at Dolgarrog were proceeding quickly, and the work was being urged forward at all speed to finish it in time to receive the two machines of 5,000 kilowatts, which would be ready for delivery in a short time. The company hoped to be able to avail itself of the power provided by this large expenditure before the end of the summer.

Legal.

Marconi's Wireless Telegraph Co., Ltd., v. Mullard Radio Valve Co., Ltd.

The appeal of the Marconi Co. in its litigation with the Mullard Radio Valve Co. regarding an alleged infringement by the latter of letters patent for inventions of "Improvements in receivers for use in wireless telegraphy" and "Improvements in or relating to vacuum tubes of the Audion type," has now reached the House of Lords, where arguments are proceeding as to the correctness or otherwise of the judgments of the Court of Appeal and Mr. Justice P. O. Lawrence, holding that the patents, although valid, had not been infringed by the Mullard Co. The principal matter in the appeal is Round's patent of 1913, in connection with wireless telegraphy. The hearing occupied much time in both Courts below, and is expected to take some days in the House of Lords. Sir John Simon, K.C., opened the case for the Marconi Co. in a speech in which he explained at length the history of wireless telegraphy.

The Postmaster-General v. The London & South-Western Railway Co. and the Great Western Railway Co.

THESE actions were brought by the Postmaster-General in the King's Bench Division on February 25th and following days for a decision whether a right to free conveyance of stores for the repair of telegraph lines extended only to stores required for the repair of certain lines, or to stores conveyed for the repair of telegraphs anywhere. The arguments in the first action turned upon an agreement arrived at in 1876. By this indenture the Postmaster-General agreed to convey messages for the railway company in return for the free conveyance of telegraph repair stores and personnel. In giving judgment for the defendants Mr. Justice Bailhache said that he construed the agreement as giving the Postmaster-General the right to free conveyance of material for the repair of lines by the railway track only. A similar judgment was given in the action against the Great Western Railway Co.

Claim for Radio Set.

IN Dunfermline Sheriff Court recently, Mr. E. J. Taylor, electrical contractor, Lochgelly, sued a Dunfermline chemist for £23 13s. 6d. in respect of a wireless receiving set installed in the latter's house. The defender, who denied liability, declared that the installation was second-hand, unsatisfactory, and incapable of receiving from English broadcasting stations. The pursuer, in evidence, stated that the set was capable of receiving broadcasting from English stations under favourable conditions, but he had never made a guarantee, not having received any guarantee from the manufacturers himself. The Sheriff reserved his decision.

The Supply of Electricity by a Gas Company.

IN the Chancery Division recently the Salcombe Gas & Coke Co., Ltd., asked for confirmation of an alteration of the objects of the company to include the supply of electricity for lighting and power. Mr. Justice Russell confirmed the alteration subject to the alteration of the title of the company by the inclusion of the word "electricity."

Oliver Pell Control, Ltd., v. Telegraph Condenser Co., Ltd.

BEFORE Mr. Justice P. O. Lawrence, in the Chancery Division, on February 26th, plaintiffs claimed, as assignees, from B. C. Rayner a declaration that they were entitled to one-fourth share of the profits arising from the sale of certain instruments sold under Letters Patent No. 9,439 of 1919. Mr. Owen Thompson, K.C., was for plaintiffs, and Mr. Jenkins, K.C., for defendants.

Mr. THOMPSON said that the parties had been able to come to terms. The action was rather a complicated one and involved the taking of an account. Plaintiffs were entitled to a share of profits in the patent. Mr. Jenkins's clients were the persons who had to pay plaintiffs the share. They had come to terms which would be scheduled to the Order. They proposed to stay all proceedings in the terms in the schedule, and there would be no order as to costs.

Mr. JENKINS said that there was only one point that he wanted to make. The plaintiffs were the assignees of an agreement made between defendants and Mr. Rayner. That agreement was dated January, 1921, and Mr. Rayner had had a receiving order made against him in April, 1921, and had since been adjudicated a bankrupt. The trustee had given defendants notice that a receiving order had been made, by which he was constituted receiver of all moneys coming into defendants' hands on behalf of the debtor, and that they should be forwarded to him. Defendants said that no money was accruing with them on behalf of debtor. The date of the original agreement was October 7th, 1919, and of the assignment January, 1921.

His LORDSHIP said that he could not do anything to affect the rights of the trustee in bankruptcy.

Mr. JENKINS: I agree. We are paying him a considerable sum—£600—to settle all matters of account up to date. Although we agree that this £600 is not money coming to us on behalf of debtor, still we do not want the claim made against us by the trustee.

The JUDGE: I think you should communicate to the trustee the terms of settlement. If he desires to intervene, I will put the matter down in the paper for March 4th.

This was agreed to, and stay of all proceedings in the action was granted, except for the purpose of enforcing the terms of settlement.

Claim for Lighting Plant.

AT the Sheffield County Court, on February 21st, Messrs. T. B. & W. Cockayne, electrical engineers, sued Mr. G. Oxley, builder and contractor, for £39 in connection with the sale of an "Austin" electric lighting set. Defendant admitted the bulk of the claim, but counterclaimed £49 on account of the alleged faulty operation of the plant. Plaintiffs stated that any failure in operation was due to the defendant's negligence in the running of the set. They admitted that it had been found necessary to replace the original ignition coil with a magneto, but maintained that any trouble which occurred thereafter was no fault of theirs. The Judge gave judgment for the plaintiffs, and dismissed the counterclaim with costs on the High Court scale.

British Thomson-Houston Co., Ltd., v. Irradiant Lamp Works, Ltd.

THIS case came before Mr. Justice Eve in the Chancery Division on February 29th. Mr. COURTNEY TERRELL said he appeared for individual defendants. The action was for the alleged infringement of letters patent which had recently been found valid by Mr. Justice Russell. The defendants were a company and a number of persons who were said to be directors of the company. The company defended the action on the ground of the alleged invalidity of the patent, and the directors had put in a separate defence and relied on non-infringement. The statement of claim stated that the defendant directors were actively engaged in the affairs of the company, and permitted or took part in the alleged infringement. In their defence the defendants said that none of them had infringed, or intended to infringe, the patent as alleged. He now applied to his Lordship for an order on the plaintiffs to give particulars of the acts upon which they relied in support of the allegations they made.

Mr. TREVOR WATSON, for the plaintiffs, opposed the application, stating that the participation of the directors in the affairs of the company was such as to make them liable for the consequences of the company's alleged tortuous acts.

His LORDSHIP said he thought after that explanation by Mr. Watson that the defendants were not entitled to the particulars for which they asked. If it turned out that the plaintiffs desired at the trial to rely on any express direction by any one of the defendants, it would be necessary that particulars should be given of that direction before the evidence was admissible at the trial. The costs of the present application would be costs in the action.

British Thomson-Houston Co., Ltd., v. Shulman.

IN the Chancery Division, on February 28th, Mr. Justice Eve heard an application on behalf of the British Thomson-Houston Co., Ltd., to attach Emanuel Shulman and his wife and daughter for breach of an order of March 27th, 1923. Mr. Fortune, for the plaintiffs, said that Mr. Justice Romer granted an injunction by consent restraining the sale of electric lamps constructed in infringement of the plaintiffs' patent. Mr. Moritz, for the defendants, said the male defendant alleged that he had nothing whatever to do with the matter, but that the female defendants were concerned in carrying on the business.

Evidence was given by a representative of the plaintiffs and by the defendants.

His LORDSHIP said he would make no order against the female defendants. He was quite satisfied, however, that the male defendant was an unprincipled rogue, and that the various devices to which he had resorted were attempts to get rid of the effect of the judgment to which he had submitted. He made an order for a writ of attachment for the defendant's arrest, and he ordered him to pay the costs of the application

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Wiring in a Corrosive Atmosphere.

Your readers always show a vivid interest in practical problems, and a discussion in your columns generally results in their elucidation. The following, which has exercised the writer's mind for some time in connection with the lighting of industrial establishments, may prove of interest.

The works in question consist of a number of buildings in which a variety of processes are carried out, involving the following combinations of conditions to which the wire would be exposed:—

(1) Steam vapour in quantity, carrying in suspension particles of animal and vegetable oils which attack rubber. In addition, a hot atmosphere.

(2) Boiling processes involving the evolution of a grease- and salt-saturated steam vapour, accompanied by a hot atmosphere.

(3) An atmosphere varying in temperature, always moist, and generally carrying lime and caustic-alkaline particles, which are found to set up rapid corrosion on steel or brass.

(4) Dry and excessively hot environment, such as boiler houses.

General.—Frequent extensions and alterations to point locations.

In the past it has been found that open v.i.r. wiring on porcelain cleats has had a very satisfactory life under any and all of the above conditions. With the increasing utilisation of space and the necessity for meeting statutory conditions as regards whitewashing, painting, and the like, this system has become liable to mechanical damage, with an undesirable increase in the fire risk. It is on this account ruled out. Heavy-gauge conduit has its uses, but, as is well known, it is practically impossible, unless the expense of a completely watertight system is incurred, to exclude moisture. Under the above conditions (1), (2), and (3), the interior

of the conduit is attacked, as well as the exterior, and the insulation is found to perish much more rapidly than if the interior is dry.

"Toughened" rubber has proved very serviceable indeed, but it is susceptible to attack by oils, and it is difficult to ensure absolute freedom from the penetration of moisture to the lampholders and switches. It cannot be put satisfactorily into porcelain cleats, and if it is necessary to attach it to steelwork, wood battens for its support become essential if the work is to be carried out at a reasonable cost. Here, again, the fire risk enters, and must be considered.

Lead-covered wire, if protected from mechanical damage, gives reasonable satisfaction as regards the life of the wiring, but it requires timber to support it in buildings, and fittings require special attachments if continuity and watertightness are to be obtained.

The problem, then, is to ascertain from the economical, electrical, mechanical, and fire-risk aspects the best form of wiring to meet each of the cases (1), (2), (3), and (4), and your readers are invited to assist in its solution.

H. A. D.

February 28th, 1924.

Squirrel-cage Motors of over 5 h.p.

We have noted with considerable interest the discussion that has been carried on in your recent issues with regard to the characteristics of squirrel-cage motors, and, although we had no intention of taking part in this controversy, the letter in your issue of the 22nd from Brittain's Electric Motor Co. compels us to do so.

This firm, referring to centrifugal clutches, says: "This type of clutch has its uses, but we have never yet come across one that could be depended upon. For general utility, he (Mr. Davies) seems to have overlooked the hand-operated friction clutch and pulley on the motor shaft."

This is not only a very drastic statement to make, but, on account of its inaccuracy, may leave a false impression. We beg to say that during recent years we have supplied large numbers of these clutches for squirrel-cage motors up to 250 h.p., and, judging from the number of repeat orders received, we can only assume that these have given every satisfaction. If troubles have occurred in a few isolated cases, these have usually been due to the clutch not being properly fitted or adjusted, and not to any mechanical defects.

A centrifugal clutch, correctly designed to suit the required conditions, will automatically ensure easy starting of any size of squirrel-cage motor against full-load torque with a star-delta starter, and will give long service without the slightest trouble or attention beyond periodical lubrication.

With regard to the hand-operated friction clutch and pulley, we may say that on numerous occasions we have supplied centrifugal clutches to supersede these. Quite recently one of the largest cotton mills in Lancashire scrapped a large number of these that had been fitted to motors driving ring spinning frames and installed automatic centrifugal clutches in their place. Previous to the change-over they experienced an endless amount of trouble with the hand clutches, which has now been entirely overcome. This firm realised that it had been ill advised to consider the hand clutch, and made the change-over at considerable expense, and has never regretted doing so.

If Brittain's Electric Motor Co. will state a definite case where a centrifugal clutch has failed to give satisfaction, we are prepared to supply and install a clutch under test conditions and guarantee this to give absolute satisfaction.

A squirrel-cage motor with centrifugal clutch and star-delta starter is unquestionably the ideal drive, and can be installed at considerably less cost than a slip-ring motor. Not only will maintenance costs be reduced, but the motor can be depended upon to give continuous and efficient service for a long period, without any starting or running troubles.

Another very important advantage of the centrifugal clutch over the hand-operated clutch is its ability to slip at any predetermined overload, for the shoes can be regulated to limit the torque that can be transmitted. The motor is thus completely and automatically protected in two ways:—

1. Easy starting against full load.
2. Protection against overload.

We must apologise for joining this discussion, but as we are probably the largest makers in the world of this type of clutch, we could not let the statement made by Brittain's Electric Motor Co. go unchallenged.

Thomas Broadbent & Sons, Ltd.

F. J. Broadbent, *Director.*

Huddersfield, *February 28th*, 1924.

What is a "Megger"?

I note that even Mr. Vignoles (notwithstanding the 20 years' educational campaign he has conducted) cannot give a very good definition in reply to the above query. Of course, his definition is quite clear to electrical instrument makers, but is faulty in that it is dependent upon everyone's knowing what an ohmmeter is, and also knowing the general requirements of the generator used in conjunction with it.

If he were to take a leaf (the power factor page) from the book of my friend, Captain Amberton, he would obtain some excellent definitions—and also some most interesting revelations which might clear up part of his surprise. I agree that it is sad to have to make such valiant efforts to educate the electrical public and then find that all they know is that the mysterious box known as you-turn-the-handle-and-we-do-the-rest-Megger is the only instrument which really ought to be used for testing insulation resistance—of course, this is not without certain commercial compensations, but it is not the reply to "What is a Megger?"

R. Borlase Matthews.

East Grinstead, *February 25th*, 1924.

Insulated Bearings.

Whilst examining a rotary converter recently, I noticed that the end bearings of the machine supporting the armature shaft were insulated from the bedplate, even the bolt holes being bushed, and, on testing the armature shaft to earth, I found this to read "Infinity." I should be glad if any of your readers could advise me what is exactly the object in keeping the shaft insulated from earth. The machine in question converts h.p. three-phase a.c. to 500 volts d.c. The neutral point of the three-phase supply is earthed at the supply company's power station.

Curious.

February 28th, 1924.

[Presumably the object was to prevent currents from circulating through the shaft and bearings; an article on this subject appeared in our issue of October 5th, 1923.—Eds., Elec. Rev.]

Tramway Improvements.

I, in common with most tramway engineers, have been waiting for further information to be published regarding the operation of various improvements made, or suggested, during the past twelve months in tramcar construction.

For example, most of us observed in the daily Press, under the heading, "The Last Word in Tramcars," photographs of a tramcar constructed for the Hull Corporation which (though most, no doubt, felt that the differential gear had claimed another victim who had not profited by past experience) had some other points which appeared worthy of trial. Has the last been heard of this "last word"?

Another attractive idea put forward about the same time was that of coupling two single-truck cars together permanently. From memory, this was put before a meeting of the Tramways and Light Railways Association last summer as a suggestion, and I think it met with general approval, but nothing has yet been published regarding its application, to my knowledge. Has it since been found to be impracticable?

Various other improvements, or alleged improvements, were also much advertised at the time and, if all of these have not come up to the expectations of their sponsors, it would benefit us to know in what respects they have failed.

So far as can be seen, the only improvement in recent years is the introduction from America of high-speed traction motors, and this modification, it can be truly said, was obvious from the first, meaning nearly 40 years ago, but was retarded by the want of knowledge in design, both of motors and gears.

We have not yet had great experience on this side of the Atlantic with these motors, and it is not at all certain that single-reduction gears with their smaller pitch and shorter and narrower teeth are the best solution.

The disastrous experience with double reduction spur gears in the early days of electric traction appears to have prevented manufacturers speculating again in that direction.

A. J. S.

February 25th, 1924.

A Non-technical Explanation of Power Factor.

I should like to put the query, arising out of the recent competition, whether the problem of explaining power factor to the non-technical consumer is not being attacked at the wrong point?

Judging by some of the essays which you were kind (or tolerant?) enough to print, the pressing need appears to be the education of the would-be expert himself as to the exact nature of the phenomena associated with low power factor.

For example, in Mr. C. Turnbull's essay, which was awarded one of the first prizes, the second and third paragraphs, as printed in your issue of February 15th, contains some very surprising statements. Can that gentleman explain how current can be "absorbed" by a motor and then "returned to the mains," and what becomes of the current which the motor "actually uses." The remark about "mouthsful" and "spitting back again" is too silly for words. Also, how does a generator "absorb" a current, and then "give it out again?" These statements in his essay are quite clear and explicit, and admit of only one interpretation.

Strangely enough, Mr. Amberton's essays convey the same idea. In one (Elec. Rev., Feb. 15th) he says an electric motor which only requires 15 effective amperes to run it, but actually takes 20 and returns 5," and "motor takes 20 amperes and only uses 15." In the other essay (Elec. Rev., Feb. 22nd) the resemblance to Mr. Turnbull's statement is even more close; he says, "Some electric motors take more

current from the mains than they actually use. The unused part they return to the mains."

There is no indication that any of these statements are not to be taken to mean exactly what they say. They are direct and unequivocal. The efforts containing them were adjudged as among the best out of "a large number of entries." If that is so, one shudders at the thought of what may have been perpetrated in some of the worst.

If this is the kind of thing by means of which it is sought to educate the consumer, it is not to be wondered at that failure is met with. If analogy *must* be used (although the competition seems to have shown the futility of this), at least the facts should not be distorted to fit the analogy. Alternatively, the would-be demonstrator should make sure that he has the facts before attempting to find an analogy for them.

The competition is over, and we are apparently as far from a solution of the problem as ever, with all due respect to Mr. Allen's opinion, as reported by you, that "the competition has been of enormous value."

May I subscribe myself, as before,

Cui Bono?

Rosyth, *February 25th*, 1924.

A Transmission Line Problem.

As the correspondent referred to in the article on "A Transmission Line Problem," published in your last week's issue, I was very much interested in Mr. Lacey's ingenious method of solution. Although interesting, however, from an academical point of view, the method appears to be too lengthy for use in actual practice. Probably, as mentioned in the article, no graphical solution is possible apart from one involving either the plotting of a curve, or the algebraic solution of a quadratic equation during the course of the work. So far, the best practical graphical method of solution I have seen is that given by P. de Baucarel in the *Revue Générale d'Electricité*, p. 43, July 14th, 1917.

H. Waddicor.

Sheffield, *February 26th*, 1924.

Plumbing Joints.

While employed on laying and jointing telephone cable, great difficulty was experienced in getting a plumb which would stand air pressure without being porous, and blowing bubbles when covered with soap solution.

As this trouble had to be overcome, I endeavoured to find literature on the subject, but without success. I then had to make an investigation for myself. I found that the joints made by one particular jointer were invariably air-tight; further, that this man made a special feature of applying tallow the instant he had finished the joint.

On questioning the jointers separately, they all agreed that to get a sound plumb it was necessary to apply tallow. The reason given for this practice varied; some said it was (1) to cool the joint, others that it was (2) to ensure a sound plumb, and others that it was (3) to bring the tin to the surface.

Plumbing metal, when in the plastic state, consists of crystals of a high-melting-point lead-tin alloy held together by a liquid low-melting-point lead-tin alloy. As the plumbing metal on a wipe cools during the process of wiping, the crystals tend to get larger, and if the joint is too long in the making the crystals become sufficiently large to allow the liquid alloy to drain out, and a porous plumb is the result.

I found that the three reasons given above had sound foundations: (1) By cooling the wipe quickly, the liquid portion of the wipe is solidified before it can drain away; also the growth of the crystals is stopped. (2 & 3) Rapid cooling causes the outside of the wipe to shrink, and so forces a layer of molten alloy to the surface, stopping up the pores.

From the foregoing it will be realised that the tallow must be applied at the earliest second after the wipe is to shape, otherwise it will be no longer semi-plastic, and the cooling will not produce the required results.

T. A. G. Margary.

Wolverhampton, *February 26th*, 1924.

Mr. Rogers comes as near the truth as possible when he says Old Joe anointed his wipe with tallow, then handed the practice down to his mate, who in turn passed it on again, until to-day we have jointers springing up and all doing the same thing without knowing why.

It is my firm belief that Old Joe did not know the reason, and I am sure a plumber of the "old school" (who was a craftsman in every way) would never dream of finishing his wipe off with a tallow bath; the habit of spitting on the wipe was very common in the days gone by.

When a plumber did use tallow on a hot wipe it was under the following conditions: In the days of plumbing irons and in the absence of blow lamps, a plumber would mould his wipe to the required dimensions, then whilst the wipe was still hot he would allow his candle to be rubbed over the hot surface, until a film of tallow or composition was entirely covering the wipe. A ladle of molten metal about the consistency of wet sand would then be poured over the wipe, allowing a good portion to flow freely on to the wiping cloth to ensure a covering underneath.

Only by long experience and careful training could a man tell what the temperature should be before throwing off the now cooling metal, leaving a smooth, clean surface over the whole of the wipe, and at the same time taking away any rough edges of metal that might have formed in the moulding process.

This method of what is termed "overcasting" also brings to the surface of the wipe the right percentage of tin to assure a good tight job, in addition to leaving a beautifully bright polished surface.

The jointer of to-day and even the average plumber uses the blow lamp to such an extent that the real art of wiping is only found in our technical schools, where, to pass the City and Guilds examination, a student is not allowed to use a blow lamp under any circumstances whatever.

I may add that the present-day jointer or the jointer of yesterday even has a distinct style of his own in wiping which is only noticeable to a man who has a wide experience of such work; to go into the details of these matters would take up too much space.

Perhaps I may be right in pointing out the absurdity of using tallow on a finished wipe to prevent finger prints or painters from defacing the pride of their brother tradesman.

Petrol would soon remove any trace in or on a cold-water system, and as tallow has a very low melting point and the wipes of a domestic hot-water supply very often attain a temperature of 200 deg. F., it will readily be seen that the tallow in question would cease to have effect if effect it ever had.

Speaking from a technical point of view, it would appear reasonable to say that if the present-day or future jointer had a little more training with regard to the finer points of plumbing and were more fully instructed in the use and abuse of his metal, we should have very few leaky wipes, and thus save expense, and our engineers would escape many sleepless nights.

J. R.

February 26th, 1924.

As one who has plumbed joints on all classes of work, it is to me almost unbelievable that anyone connected with cables and joints should imagine that tallow is applied to fill up cracks, &c.

Why the cracks? I have never had one crack except by accidental disturbance before it cooled; further, when tallow removes my "black." I shall use no more of the latter. What is the use?

Now, I am no "expert plumber," but, as Mr. Welbourn knows, if a pot of plumbing metal is heated, then allowed to "cool off," at a certain temperature the tin can be easily made to part company with the other element, *i.e.*, lead, leaving a lump of lead which is absolutely cellular and porous. This is the basis of my reason for using tallow.

A good "wipe" is the one carried through *quickly*, and, after having done so, the applied tallow admittedly cleans, but chiefly "fixes," the metal by chilling; thus ensuring that the tin does not all run to the bottom of "wipe," leaving porous lead at the top. Further, the tallow will also, to some extent, prevent mild acid attack upon the tin in the metal.

In conclusion, the secret of good plumbing is speed, so that consistency of metal is maintained so far as is possible, then no more "cracks."

Not An Old Timer.

Ebbw Vale, Mon., *February 25th*, 1924.

There are numerous reasons why tallow is used by the plumber for wiping joints. First, it is used to assist, as a flux, the tinning of the ends of water pipes or the lead sheath of the cables, which is most important in the wiping of a sound water-tight joint.

Secondly, it is used immediately after the completion of the wipe to gently cool the joint on a water pipe, the ends of which are often held together by a simply-devised clamp, or weights, the slightest movement of which would break or crack the joint. Thirdly, during the process of cooling the metal contracts, and if it is coarse and still in a spongy state it will absorb a certain amount of the molten tallow in the very fine honeycomb-like cells, often preventing sweating which may occur to a water pipe under water pressure.

Fourthly, the highly-experienced plumber can detect any defect in his wipe immediately he applies the tallow. If there is a small hole in the wipe, he will find a very small air bubble; or if a crack, he will find a dark line which holds a portion of the tallow and enables him to detect it quickly. Tallow is not used to remove the tarnish or black from the joint, for the man who takes a pride in his work always endeavours to leave this as a sort of finish or frame to his work.

Salford.

The letters re the above subject have interested me, as I had over ten years' practical experience with lead and lead-alloy pipes years ago.

At the time I am writing about (1890), plumbed or wiped joints were only known on the very best jobs, and our jointing tackle consisted of an old file, an old knife, a shavehook, a mouth blowpipe, powdered resin, and a *double*-wicked tallow candle, together with a tanpin. We also had a soldering iron which was only used for tinning brass unions, &c., before soldering them into the pipe.

To join two straight pieces of lead pipe we followed this procedure: The top piece was tackled first, being filed to

taper the end; then the shavehook was used to take off the outer layer of dull lead; then it was rubbed with the tallow candle to keep off damp and in case it should be touched by the hand. (Not because old Joe told me, but experience proved it was easier to blow a hole in the pipe than get the solder to adhere if this should happen.)

Next, the bottom piece was opened with the tanpin, cleaned inside the lip with the knife, and rubbed with tallow. The two pieces were fitted together, and the art of the industry was to fill the nick with solder neatly and cleanly so that it would withstand the pressure of the water mains.

We will pass over the fun that happened when it was a windy day and the pipe was in an exposed position, but presume we have been successful, and now we want to clean the joint and make sure we have no blowholes, so we use the tallow candle and wipe off the liquid fat with a bit of rag, and can soon tell if our joint is O.K. or not. The solder we used was equal parts of lead and block tin, but we always mixed and ran our own. Of course, with the advent of the metal-pot and spirit blow-lamp, the old-fashioned blown joint went out, and is now seldom seen.

In the early days of lead-covered main cables, the poor old plumber was requisitioned, and he it was who showed jointers the use of tallow. There is still one firm in this district that manufactures tallow candles, and I believe still makes the double-wicked ones, or "eights," as we called them; that was, eight to a lb. for 2½d.

Should Mr. Welbourn be interested, I shall be pleased to write you further *re* the jointing of block-tin spirit pipes, "compo" gas pipes, and block tin-lined lead beer pipes, giving details of the solder mixture and flux used before the days of patent fluxes, but when all were done with the good old tallow candle and mouth blowpipe.

Peeping Tom.

February 25th, 1924.

Letters have been received, too late for insertion in this issue, from The Concordia Electric Wire Co., Ltd., Mr. Ben Ansell, "Electrical and Mechanical Engineer," Mr. C. F. Wood, and "X.Y.Z."

Business Notes.

Back Numbers Wanted.—We desire to secure back numbers of the REVIEW for the following dates and should be glad to hear from any reader who is willing to dispose of them:—

1915.—October 8th.
1916.—April 28th.
1918.—All issues except a few in November and December.
1921.—January 14th and March 11th.

Bankruptcy Proceedings.—HENRY PYNEGAR, SENR., merchant and shipper, 5, Dowgate Hill, E.C.—The public examination of this debtor, who dealt in iron and electrical goods, was held at the London Bankruptcy Court on February 26th before Mr. Registrar Mellor. The statement of affairs disclosed liabilities of £21,586, of which £7,278 was due to 62 unsecured creditors, while the assets were estimated to realise £462 net. Questioned by the Official Receiver, the debtor said that before 1891 he was employed by a firm of engineers. He then began business as a merchant and shipper. He borrowed £250 as capital, and traded at 5, Dowgate Hill, E.C. He obtained orders from abroad for goods which he shipped and in respect of which he drew bills of exchange on the customers. Unfortunately, one of his customers in Siam failed last year, and the bank which held the bills claimed £10,355 against him in respect of bills drawn by him on one of his customers and discounted by the bank. As he could not meet the claim on the bills, he filed his petition. The debtor attributed his insolvency to bad trade and to liability as drawer of the said bills of exchange. The examination was concluded. The following are creditors:—

	£		£
Barford & Perkins, Ltd. ...	... 420	H. J. Pilbrow	... 750
S. Bill & Co., Ltd. ...	... 45	Potter Rax Gate Co., Ltd.	... 32
Cable Accessories Co., Ltd.	... 225	Prestwich Smallware Co.	... 53
T. Harrison Carter, Ltd.	... 48	H. Pynegar, Junr. ...	3,951
Arthur Cort & Co.	... 15	Siam Import Co., Ltd. ...	... 231
Cranmore & Co., Ltd. ...	... 68	Siemens Bros. & Co., Ltd.	... 26
Engineering Supplies, Ltd.	... 52	Simpson, Lawrence & Co.	... 38
Falk, Stadelmann & Co., Ltd. ...	43	Slazengers, Ltd.	... 23
General Cable Manufacturing Co.	30	Steel Tubes & Conduits, Ltd.	... 56
Exors. of Bromley Hall ...	... 36	N. V. Telga, Ltd.	... 87
Houlder Bros. & Co., Ltd	... 108	Veritys, Ltd.	... 135
Jeevanjee & Co.	... 40	Walsall Conduits Supplies Co.	... 29
J. N. Keshan	... 150	Ward & Goldstone, Ltd.	... 62
Maltzahn & Springer (Berlin)	... 28	Wantage Engineering Co., Ltd.	16
A. H. & W. T. Maynard	... 110	Burgoyne & Co., Ltd. ...	... 39
M. C. A. Meischke (Johannesburg)	64	Fully secured	1,130
Mullard Radio Valve Co., Ltd.	22	Contingent	13,160 (not expected to rank.)

B. N. HALSON, electrician, 29, Mayfield Road, Northfleet, Kent.—Last day for proofs for dividend March 12th. Trustee, Mr. A. H. Ward, Official Receiver, 280a, High Street, Rochester.

R. V. MCLAUGHTAN, electrical engineer, 5, Gordon Street, Paisley.—Dividend payable April 2nd at the offices of Mr. A. Rolland, 9, High Street, Paisley.

A. WILSON, electrician, Market Place, Howden, Yorks.—First and final dividend of 2s. 4d. in the £, payable at the Official Receiver's office, 36, Scale Lane, Hull.

F. B. THORPE, electrical engineer, 73, South End, Thorne, York.—First dividend of 5s. in the £, payable March 8th, at 99, Albion Street, Leeds.

J. MICHAEL, electrical engineer, 6, Sneyd Terrace, Silverdale, and 20, George Street, Newcastle-under-Lyme.—Last day for proofs for dividend, March 17th. Trustee, Mr. F. T. Halcomb, Official receiver, 12, Lonsdale Street, Stoke-upon-Trent.

A. VIVIAN, electrical engineer, 180, Grays Inn Road, W.C.—First and final dividend of 2s. 3d. in the £, payable at Carey Street, W.C.

A. C. INCE (lately trading as the Newcastle Electrical Engineering Co., now with a partner under the style of the Tyne Electrical Industries), electrical engineer, 21, Fenkle Street, Newcastle-upon-Tyne. Trustee, Mr. C. Woollett, official receiver, 4, Northumberland Street, Newcastle-on-Tyne, released February 13th.

S. B. WESTON (Westforrest Radio Co.), wireless apparatus manufacturer, Utworth Manor, Cranleigh, and Playhouse Arcade, High Street, Guildford. Last day for proofs for dividend, March 17th. Trustee: Mr. T. Gourlay, 29, Russell Square, W.C.1.

L. R. HEUSON, electrical engineer, 23, Green Lanes, Islington, N. Trustee, Mr. F. T. Garton, official receiver, Carey Street, W.C., released February 4th.

ROBERT STOCKMAN MACE, 4, Swanhurst Lane, Kings Heath, Birmingham, late 8, Washington Street, Birmingham, lately trading as Mace Bros., general brassfounder.—The adjourned first meeting of the creditors of the above was held on February 27th, at the Official Receiver's office, Ruskin Chambers, 191, Corporation Street, Birmingham. The statement of affairs showed gross liabilities of £1,694, against assets of £366. Debtor attributed his failure to speculation on the Stock Exchange, bad trade, ill-health, and losses incurred in the manufacture of wireless goods. The creditors decided to accept a proposal by the debtor for the payment of a composition of 6s. 8d. in the £.

Company Liquidations.—A. C. ALEXANDRA & CO., LTD.—The first meetings of the creditors and shareholders were held on February 26th at Carey Street, W.C. Mr. G. D. Pepys, Official Receiver, reported upon the circumstances attending the formation and history of the company, and said that a statement of affairs had been lodged showing total liabilities of £8,668, which included £3,965 owing to depositors, and assets valued at £1,366. He expressed the opinion, however, that the latter amount was excessive, and that the assets were not likely to produce £200. In addition, the trustee under Mr. Alexandra's bankruptcy had notified that he claimed the whole of the assets. Mr. Alexandra said a new company had been formed, and arrangements would shortly be submitted under which a substantial cash payment would be made to the creditors, and shares in the new company would be allotted in lieu of the shares held in the old company. The liquidation was left in the hands of the Official Receiver.

In reporting upon the position, Mr. G. Digby Pepys stated that the winding-up order was made on November 13th, 1923, upon the petition of a creditor. The company was formed on July 5th, 1923, and the petition to wind it up was lodged on July 1st, less than two months from the date of incorporation. It took over the assets and liabilities of a business which had been run for a short time by Mr. G. W. A. C. Alexandra, and the real history of the company was the history of that gentleman's business. It was promoted by Mr. Alexandra as a private company with a nominal capital of £20,000 in shares of £1 each. The directors were Mr. Alexandra, Mr. J. A. Spencer (resigned September 5th, 1923), Mr. Wm. Kelsey (resigned September 17th, 1923), and Mr. Leonard Drake. The qualification of a director was the holding of 600 shares, and Mr. Alexandra, as the permanent director, held 2,000 shares. He was appointed managing director for ten years at a fee of £1,200 per annum, but after his bankruptcy he was appointed manager, temporarily, at a salary of £6 per week; he had not received his salary in full, and was now returned as a creditor for £763 in respect of salary and loans. It appeared that in August, 1922, he commenced business under the name of A. C. Alexandra & Co.; it consisted mainly of the sale of electric lamps, and it grew rapidly under a system of the employment of travellers and district managers, but the expenditure was apparently out of all proportion to the gross profits, and the business was carried on at a loss throughout. It depended upon deposits which the district managers and others paid upon taking up their posts. Those gentlemen had asserted that they were induced to make these deposits by misrepresentations, and that the payments were purely deposits as guarantees of their integrity, and not loans or investments in the business or company. This was denied by Mr. Alexandra, and the whole matter was being investigated by the Official Receiver. The intention of Mr.

Alexandra was to acquire a factory where "Omega" lamps could be manufactured, and he formed this company for the purpose of raising capital with which to purchase the factory and take over agencies which he had secured. It would seem that this business was always short of capital, and the formation of the company was delayed from time to time because there was no prospect of raising the purchase money for the factory or obtaining a reasonable amount of working capital.

The sale agreement under which the company bought the business provided for the acquisition of the assets for £9,000 in shares, the company undertaking to discharge all the outstanding liabilities of the vendor. A balance sheet prepared for the purpose of the sale which was to date from March 1st, 1923, showed liabilities of £4,026, and assets of £13,026. The liabilities included £2,649, representing deposits and interest, but it was found subsequently that this amount had to be increased by £1,165. The assets comprised sundry book debtors, £1,320; stock, £940; furniture, £471; cash, £295; and goodwill, £10,000, although the company had only been in existence for six months, and the trading had been carried on at a loss. The issued capital was £10,112, of which £9,000 was issued as fully paid to the vendor. At the time the company was formed the business taken over was rapidly falling away; proceedings had been taken against the company, and against Mr. Alexandra personally, by depositors for the return of their deposits, and by other persons; resignations came in from various travellers and other employés of the company, and, in consequence, the business became practically dormant. Its liabilities, however, increased, and the creditors became more and more pressing. The trading accounts, which dated from March 1st to November 13th, 1923, showed purchases, £2,617; sales, £3,059; gross loss, £394; and net loss, £5,400. Efforts were made, apparently by Mr. Alexandra, to raise funds for working capital. He approached three firms of financial agents, and one of the number offered 8,000 shares to the investing public; a large number of prospectuses, headed "Private and confidential," were issued, with the result that applications were received for 60 shares. A second firm also issued a number of prospectuses, but without eliciting any response from the public. The company had to pay the cost of printing the prospectuses, and it was arranged that it should pay a commission on the amount subscribed. This, observed the chairman, was merely a device to obtain capital from the public, and in view of the fact that it was a private company and was consequently precluded from issuing invitations to the public, the matter would have to be fully investigated. During the time that Mr. Kelsey was acting as a temporary director disputes arose concerning the management of the business; the banking account was stopped, and cheques received on behalf of the company instead of being paid into the banking account, were in some cases endorsed and handed over in payment of wages and goods, whilst others were cashed by Mr. Alexandra through his wife's banking account. During the latter stage of the company's existence Mr. Alexandra made every effort to stave off liquidation, but its difficulties were increased by the landlords of Iddesleigh House distraining on the effects for rent. Since the winding-up order was made Mr. Alexandra had been interested in the promotion and registration of another company with a view to settling the claims of the present creditors and shareholders.

Commenting upon the statement of affairs, the chairman pointed out that £3,965 of the liabilities of £8,668 represented sums due to depositors and interest thereon, and the assets, although returned at £1,366, were considerably over-estimated, and would not yield more than £220. He had collected £100 on account of the book debts, and anticipated receiving a further £50 from the same source.

Mr. Alexandra remarked that the figures given by the Official Receiver included his banking figures.

The chairman said he had read from the statement showing the company's position at the date of the winding-up order.

Mr. Alexandra furtner stated that under his scheme a substantial sum would be paid to the present creditors, and the shareholders would receive the same number of shares in the new company. The scheme was well backed from a financial point of view, and the terms would be completed and sent round to the interested parties very shortly.

GOODALL ELECTRIC, LTD.—A meeting of members is called for April 2nd, at the offices of Messrs. McKnight & Hurst, 13, Union Court, Liverpool, to hear an account of the winding-up from the Liquidator, Mr. J. G. Hurst.

Dissolutions of Partnership.—RAWLINGS & Co., electrical engineers, 33, Broad Street, Hereford.—Mr. H. T. Turmaine and Mr. C. Rawlings have dissolved partnership. Mr. Rawlings will attend to debts and continue the business.

LIGHTFOOT BROTHERS, plumbers and electricians, 17a, Cooper Street, Manchester.—Messrs. J. and T. Lightfoot and Elizabeth Lightfoot have dissolved partnership.

LEIGHTON GARAGE, motor and electrical engineers, &c., High Street, Wellingborough.—Mr. T. Armitage and Mr. J. G. Tookey have dissolved partnership.

Trade Announcements.—MESSRS. ELECTRICAL PRODUCTIONS, Excelsior Works, Ellis Street, Birmingham, have secured the whole of the stock, plant, and designs relating to the "Ventex" fuse system, and they have arranged for this to be produced on a much larger scale than hitherto.

MESSRS. SNELL, of Union Street, Plymouth, a cycle firm, have opened a new department for wireless sets and accessories.

MESSRS. WAKES have secured a site in Raleigh Street, Plymouth, for the establishment of a factory for the wholesale manufacture of wireless sets and parts. Operations have been commenced with a staff of sixty women and girls.

Mr. F. Rook, who has been appointed sales manager to GENERAL ENGINEERS & MERCHANTS, LTD., 137, Victoria Street, S.W.1, wishes to receive manufacturers' price lists.

British Empire Exhibition Note.—THREATENED STRIKE.—A meeting of members of the Electrical Trades Union employed at the Exhibition decided on Monday last to stop work on Thursday (yesterday) owing to the fact that a number of non-union electricians, working at less than standard rates, were being employed. The matter was to have been considered by the Exhibition board and a decision given before Thursday.

Catalogues and Lists.—MESSRS. BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester.—Price Lists Nos. 6 and 9, dealing with motor starting equipment for marine employment. Fully illustrated.

MR. J. R. MORRIS, Imperial House, 15-19, Kingsway, W.C.2.—An illustrated pamphlet advertising the "Columbia Radio A" dry cell for use with dull emitter valves.

THE E.G.S. Co., LTD., 18-26, Constitution Hill, Birmingham.—An illustrated folder dealing with "B.A.G." diffusers for gas-filled lamps.

THE BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—February "Bulletin" dealing principally with the lighting of offices, shop windows, show cases, &c. Also a mailing card bearing a special offer in connection with the "Dim-a-Lite" portable lamp.

THE BRITISH CENTRAL ELECTRIC Co., LTD., 6 and 8, Rosebery Avenue, E.C.1.—An illustrated and priced catalogue of switchgear, wall plugs, &c.

ENGLISH ELECTRIC Co., LTD., Queen's House, Kingsway, W.C.2.—Publication No. 471, illustrating and describing ironclad truck-type switchgear.

THE LONDON ELECTRIC WIRE COMPANY & SMITHS, LTD., 7, Playhouse Yard, Golden Lane, E.C.1.—A price list of instrument wires of various types and sizes.

ELECTRIC FIRES, LTD., King Street, Norwich.—Sheet No. 2, Section D, containing illustrations and details of "Heatrae" immersion heaters.

Book Notices.—"The Control of the Speed and Power Factor of Induction Motors," by Miles Walker. Pp. 151; figs. 125. London: Ernest Benn, Ltd. Price 18s. 6d. net.

"Science Abstracts" (A. & B.). Vol. xxvii, Part 2, No. 314. February 25th, 1924. London: E. & F. N. Spon, Ltd. Price 3s. each.

Journal of the American Institute of Electrical Engineers. Vol. xliii, No. 2. February, 1924. New York: The Institute. Price $1.

"Pulverised Fuel, Colloidal Fuel, Fuel Economy and Smokeless Combustion," by L. G. Harvey. Pp. xxvi+466; 260 figs. London: MacDonald & Evans. Price 42s. net.

The *Transactions* of the South African Institute of Electrical Engineers. December, 1922. Johannesburg: The Institute. Price 2s. Two illustrated papers are reproduced in this number, "Recent Developments in Automatic Telephony (with special reference to Johannesburg)," by T. H. Watson; and "The Testing, Balancing, and Jointing of the 160-pair, 40-lb. Multiple Twin Telephone Cables between Germiston and Benoni," by A. H. A. Lyle, B.Sc., M. Hewitson, R. C. Hendrie, and E. O. Tibbits.

"The Wireless Annual for Amateurs and Experimenters, 1924." Pp. xlviii+192; illustrated map section, 32 pp. London: Wireless Press, Ltd. Price 2s. 6d.—This annual is the immediate outcome of the "Amateur edition" of the "Year Book of Wireless Telegraphy and Telephony for 1923," and contains, besides matter normally found in year books, many articles of interest to amateurs, by well-known authors. Progress made during 1923 is reviewed, and articles on broadcasting are contributed by Sir William Noble and Capt. P. P. Eckersley. Senatore G. Marconi writes on short-wave telegraphy with reflectors, showing how waves 2 metres in length can be dealt with. Loud speakers, mast construction, transmission, valves, aerials and earths, the design of receivers, time and weather signals, are amongst the subjects treated of in special articles, and there is a large amount of tabular matter, laws and regulations, lists of call signs, and directories of wireless societies, manufacturers, and retailers. Altogether it is a very useful production, and should have a large circulation amongst amateurs and experimenters.

Lead.—In their report dated March 1st, Messrs. James Forster & Co. say:—"The world scarcity of non-ferrous metals, with the exception of copper, has been once more emphasised this week on the Metal Exchange, and was particularly marked in tin and lead. The appearance of German buying of lead on February 28th, when transactions approximating 3,000 tons were recorded, was the occasion of a rise of 40s. a ton above the previous day's close, but the extreme figure was not fully maintained, the rise at the close representing 30s. per ton. With Mexican supplies available at present, without German buying, the position has been difficult enough. With such buying we are bound to have very stringent conditions."

Industrial Developments at Rugby.—According to the *Birmingham Post*, at the annual banquet of the Rugby Chamber of Commerce, Sir Arnold Gridley, of the English Electric Co., referred to recent developments in the local engineering industry, which he hoped would bring additional fame to Rugby. The B.T.H. Co., he said, was engaged in doing two things which were entirely new in the history of the engineering world. It was building, for the first big railway electrification scheme which was being carried out in South Africa, entirely novel sub-station plant and equipment, which was to operate at the highest pressure yet tried. These sub-stations were to be run automatically, a thing which he believed had never yet been done on any British or Colonial railway system. It was also responsible for the first Diesel electrically-operated ship, which had proved to be a great success. The ship had just made her first voyage across the Atlantic to America, and everything had gone well. This new experiment was of the greatest importance to the sister industry of shipbuilding. The English Electric Co. was also engaged in doing something entirely new to this country. It was building at the moment five of the largest water turbines which had ever been constructed, i.e., of 30,000 h.p. This was the beginning of a new industry for Rugby, which he hoped would grow and expand and find work for a large number of employés.

Recent Contracts.—MESSRS. EDMUNDSONS ELECTRICITY CORPORATION, LTD., have received from the Admiralty instructions to carry out the electrical work in the new magnetic observatory, Abinger. The installation includes a considerable amount of special gear.

The Liverpool Corporation has placed an order with the Tudor Accumulator Co., Ltd., for a further large battery consisting of 230 cells, having a capacity of 8,000 ampere-hours at the one-hour rating. The company also has in hand a battery for the Birmingham Corporation consisting of 264 cells, having a capacity of 2,000 ampere-hours at the one-hour rating. These orders, we understand, represent the fifth battery supplied by the Tudor Co. to each of the Corporations named during the past 11 years.

Calendar.—We have received from the YORKSHIRE TESTING WORKS, LTD., an illustrated calendar with monthly slips and reproductions of British Standard Specifications relating to wrought-iron and steel parts for carriages, wagons, &c.

A New B.T.H. Club.—The British Thomson-Houston Co., Ltd., has recently opened a Testers' Club. This organisation is limited to those who are, or have been, in the Test Department at Rugby, and to student apprentices and others connected with that department. Besides being of the utmost benefit to newcomers in affording facilities for the making of friends and curtailing the initial period during which a feeling of solitude is sometimes experienced, this society intends to look after the welfare of any members who may be in hospital or laid up away from their homes.

"Kathanode" Separators.—A striking testimony of the value of the "D.P." Battery Co.'s patent "Kathanode" separation is contained in the report of a colliery company, which reads as follows:—"During the past sixteen months the average life of accumulator plates used for 2-volt miners' electric lamps at this colliery has been ten months. Experiments with the same type of plate fitted with 'Kathanode' separators show up to the present a life of eighteen months. These plates are still in use, and on examination it is estimated that they will last four months longer."

Annual Dinner.—On February 29th the directors and staff of MESSRS. WATSON & SONS (ELECTRO-MEDICAL), LTD., gathered at the Manchester Hotel, Aldersgate Street, for their third annual dinner. Mr. Charles H. Watson, chairman of the company, presided, and he was supported by other directors, including those representing the General Electric Co., Ltd., and the British Thomson-Houston Co., Ltd., of which companies Messrs. Watson's is the X-ray and electro-medical section. By general consent the speeches were very few and short, which allowed more time for an excellent concert programme, to which Dr. Berkeley Way and Mr. Cuthbert Andrews made valuable contributions.

Social Event.—The Brookhirst Athletic Club held a whist drive and carnival dance at Chester last week. There was a record attendance, estimated at 450. The prizes, which numbered 17, included a polished oak sideboard, a lounge chair, a full china tea service, and other useful articles. Mr. Harold Jones acted as M.C. for the dancing.

Unemployment.—The "live" registers of employment exchanges recorded a total of 1,124,400 wholly unemployed persons on February 18th. This was 29,240 less than in the previous week. The reduction since the beginning of the year has been 125,710. There was also a decrease in the number of "short-time" workers—from 50,648 to 49,900.

Local Exhibition.—ECCLES.—An electrical exhibition organised by the Corporation Electricity Department was held in the Town Hall from February 27th to March 5th in conjunction with the General Electric Co., Ltd. Each afternoon and evening practical demonstrations were given in electric cooking by "Magnet" electric appliances. The public response on the opening day was not so good as the promoters could have wished, but later in the week the attendances improved. Other features of the exhibition included some of the latest lighting appliances.

Railways and British Manufacturers' Prices.—In the course of his speech at the annual meeting of the Great Western Railway on February 27th, Viscount Churchill said that they were taking active measures to overtake arrears in renewal of rolling stock and in the provision of new stock to meet growth of traffic. In this connection he referred to what he described as a point of very considerable importance. We quote: "In placing orders for stores, the company has consistently followed the policy of dealing only with British manufacturers, but it is useless to ignore the fact that materials of many descriptions can be purchased abroad at prices considerably below those of British manufacturers. I feel certain that the shareholders will approve the course which has been taken by the board in the interests of British trade and to relieve unemployment. Of course, what the future may have in store for us no one can tell, and I can only hope that to enable us to continue this policy the prices charged by British manufacturers may before long come down to a more reasonable level as compared with their competitors abroad."

The F.B.I. and Taxation.—We have received a copy of a memorandum addressed by the Federation of British Industries to the Chancellor of the Exchequer, dealing with taxation and its effect upon industry. It urges that the time has come when hastily-conceived war-time impositions should be revised, and in the first place it puts the abolition of the Corporation profits tax. It is said that this bears very heavily upon the ordinary shareholders in limited companies and withdraws capital which could be used for the purposes of industry. The reduction of income tax, by even a small amount, it is said, would have an immediate effect upon industry by freeing capital for re-investment. With regard to indirect taxation, it is acknowledged that its influence upon industry is hard to trace, but it is thought that in certain directions a reduction would have a directly-beneficial effect by reducing the cost of raw materials.

Finally, it is pointed out that the whole of the existing taxation system, local and national, is far too involved, and causes unnecessary trouble to both industrialists and the Revenue authorities. Once again it is suggested that a Royal Commission be appointed to investigate the whole matter and especially the incidence of taxation and its effect upon industry. Codification and simplification of the system would be beneficial to all concerned.

Patent Restoration.—An order has been made restoring Patent No. 4,862 of 1913, granted to Thomas Edward Gambrell for improvements in electric contact makers for use with the resistance boxes, Wheatstone bridges, and the like.

For Sale.—Messrs. Hillier, Parker, May & Rowden will sell by auction, at the London Auction Mart, on March 20th, city show rooms and warehouse suitable for the engineering, electrical, and allied trades situated at 83-5, Queen Victoria Street, E.C., and 11-12, Lambeth Hill, E.C., also freehold factory premises, 156-168, Kensal Road, W.; Messrs. Leopold Farmer & Sons will also offer by auction, at the Mart, on March 26th, freehold manufacturing premises situated at 1, Ruckridge Avenue, Willesden. Heston & Isleworth Urban District Council Electricity Department has for disposal two 125-kW Davey-Paxman engines, direct-coupled to 480/550 V d.c. generators, with condensers and spare armatures; also a quantity of scrap copper, brass, &c. Sheffield Corporation Tramways Department has for disposal a quantity of B.T.H. type traction motors. By order of Messrs. Evered & Co., Ltd., who have disposed of their Drury Lane premises, and removing to the Shoreditch branch, Messrs. H. Butcher and Co. will sell by auction on March 18th and following day, at 30-35, Drury Lane, W.C., the stock of electrical fittings, &c. (See our advertisement pages to-day.)

Reduction of Reparations Levy.—An agreement has been reached between the Government and the German Government respecting the German Reparation (Recovery) Act, 1921. In pursuance of this agreement the Treasury has issued a Treasury minute reducing from 26 per cent. to 5 per cent. the proportion of the value of goods to which the Act applies, payable to the Commissioners of Customs and Excise in respect of goods imported on or after February 26th. In order to guarantee that no part of the sums levied under the Act at the above rate of 5 per cent. shall be charged to British importers, the German Government has agreed to arrange for the compensation of the German exporters at a later date, and to provide that if in any case any part of the sums levied under the Act has been charged to the British importer the German exporter will forfeit his claim to reimbursement, and will, in addition, be subject to a penalty. The above provisions will have effect until April 15th, 1924.—*Board of Trade Journal.*

Austrian Electrical Trade. — Reviewing the electro-technical trade of Austria during the past year, the *Zeitschrift* of the Austrian Engineers' and Architects' Union states that in the first half of the year trade was bad, but in the second half an improvement set in. Taking the whole year together, things were far from satisfactory. In the first half there was lack of employment, and while this was reversed in the second half, there prevailed extraordinarily low prices, imposed under the handicap of foreign competition and in order to keep the workshops fully and profitably employed. The falling selling prices throughout the year were constantly accompanied by the rising cost of production.

German Radio-Apparatus Combination.—The Association of Electrical Merchants and Exporters of Germany, 48, Friedrich Strasse, Berlin, is endeavouring to organise into a combination all the merchants in wireless apparatus throughout that country, and the actual formation of the syndicate is expected to take place in connection with the Leipzig Fair. Among other matters, the object in view is to regulate prices and prevent the placing on the market of inferior apparatus and accessories.

Esthonian Industrial Fair.—The annual Esthonian Industrial Fair will be held at Tallinn (Reval) from June 14th to 25th. Foreign firms desirous of participating are invited to send in their applications before May 15th to the secretary of the Organising Bureau (Naitus-Messe), V. Viru tanav No. 12, Tallinn (Reval), Esthonia.—*Reuter's Trade Service.*

Russian Industrial Notes.—*Export of Lamps.*—The Svetlana Works of Petrograd is reported to have despatched a first delivery of lamps of its own production to Persia.

Electrification of Rural Industries.—The statutes of the Electrical Rural Construction Company have been placed before the higher authorities for confirmation. This is a new organisation aiming at the electrification of rural industries, the founders including the National Commissioner of Agriculture, the Sugar Trust, a number of co-operative centres, and other organisations, and the Swedish General Electric Company (A.S.E.A.). The initial capital of the company is 2,000,000 gold roubles.

The Electro Credit Company.—The Central Electrical Trust and the Electrical Machine Trust, at a joint meeting on February 9th, decided to become shareholders in the Electro Credit Company by the joint subscription of shares in the last for the amount of 500,000 gold roubles. In connection with this transaction the two trusts have entered into a contract, agreeing to grant to the company a credit in goods to the extent of 1,000,000 gold roubles, in each case for a period of two years and a half. Since the end of 1923 the number of applications received by the credit company in the matter of electrification works, particularly from rural localities, has largely increased. No fewer than 56 came to hand in January, and schemes have already been worked out for 13 of them.

Home Plant Orders.—The Volchoff electrical concern has given an order to the Agricultural Machine Trust for four 3,000-h.p. turbo-generators, two 120-h.p. turbo-generators, and eight motor-generators.

Turbine Erection.—A Baku message says that in consequence of the interruption of relations between the Soviets and Switzerland, the Aznepht has declined the services of Swiss firms in the erection of a 10,000-kW turbo-generator, supplied by a Swiss firm. The Aznepht used its own resources, and the trial run made a few days ago showed that it worked quite smoothly, showing no defects.

Russians to Visit American Lamp Works.—The "Glavelektro" has made a large remittance to America for electrical machinery, and is endeavouring to obtain permission to send Russian lamp makers to America to learn the operation of the latest lamp-making machines.

New Insulating Lacquer.—The Moscow Ichtyol factory is about to begin the production of special insulating lacquers of which the original raw material is schist tar, which will be used to produce a number of insulating oils and "carbolithopon" paste, in co-operation with the Central Russian Electrical Trust.

Customs Remissions in Formosa.—The *Board of Trade Journal* states that among the articles temporarily exempted from Formosan Customs duties, in consequence of the Japanese earthquake, are electrical apparatus and railway construction material.

Census of Production.—As previously announced here, the Board of Trade is to take a Census of Production in respect of 1924. The forms have not yet been finally settled, but the particulars required will include the value of materials used, quantity produced, and selling prices, number and particulars of persons employed, and information regarding the use of mechanical power.

London Tramway Employés' Wages.—Meetings of employés of the London County Council have been held for the purpose of considering an application for a general increase of wages.

Boiler Companies' Amalgamation.—According to the *Financial Times*, negotiations have been on foot for some time for the amalgamation of Babcock & Wilcox, Ltd., and Clayton and Shuttleworth.

Patents in Brazil.—On March 1st a new Patent and Trade-Mark Law will come into force in Brazil, supplementing the Patent Law of 1893, the regulations of October 21st, 1913, and modifying the decrees of 1887 and September 24th, 1904. The main provisions of the new Patent Law relate to the publication of patent specifications before grant of patent, and will greatly modify the expenses incurred by patentees. An outstanding provision of the new law is a requirement that trade marks shall be registered in one or other of the fifty separate classes under which imported goods are now officially scheduled. When the new law comes into effect, State registration will be dispensed with, rendering it obligatory that all trade marks be registered in the national office.—*Reuter's Trade Service* (Rio de Janeiro).

Lighting and Power Notes.

Axminster.—ELECTRICITY SUPPLY.—The Electricity Commissioners have intimated that they are not desirous of giving consent to the erection of a small power station for generating electricity to supply the town. Mr. J. G. Royce, electrical engineer, of Bristol, has informed the Urban District Council that he intends to apply for powers to supply electricity in an area which includes Axminster and Bridport, by means of a high-pressure cable, with a generating station at Bridport.

Barnstaple.—LOAN.—The Town Council has applied to the Electricity Commissioners for sanction to a loan of £3,250 for the installation of a 300-kW generating set at the electricity works.

Bath.—NEW PLANT.—The Town Council has received the sanction of the Electricity Commissioners to the installation at the electricity works of a 3,000-kW turbo-alternator and two boilers, together with the necessary building extensions.

Bessecar.—ELECTRICITY SUPPLY.—The Electricity Society, which was recently formed to procure a supply of electricity for the district, has arranged for a bulk supply from the Doncaster Collieries Association. The sub-station is nearly completed, and it is hoped to have a supply of electricity available by Easter.

Bexley.—ELECTRICITY SUPPLY.—The Urban District Council has received the sanction of the Electricity Commissioners to the erection of a main transmission line in connection with a bulk supply of electricity from Woolwich.

Birmingham.—ELECTRICITY SUPPLY.—In a statement issued by the Electricity Committee, the following schemes involving capital expenditure are said to be in hand or contemplated:—Chester Street station, motor generator set, £15,000; development of eastern and southern districts, £100,000; construction of new tramways, and provision of feeder cables, £18,816; and extensions and additions at Summer Lane and Prince's station, Nechells, and equipment of sub-stations, £201,500.

Bridlington.—NEW PLANT.—The Town Council has decided to install a Lancashire boiler at the electricity works at an estimated cost of £1,655 to be defrayed out of revenue, and to extend the evaporative plant by the provision of a condenser at a cost of £4,276, for which a loan is to be applied for.

Canada.—ST. LAWRENCE RIVER DEVELOPMENT.—At the third annual meeting of the Canadian National Deep Waterways and Power Association a resolution was passed urging the Dominion Government to take immediate action, in conjunction with the United States, to facilitate the project for deepening the St. Lawrence river and the development of water power.—*Reuter* (Toronto).

HULL (QUEBEC).—According to *Power*, the Gatineau Co., Ltd., Montreal, is seeking authorisation to develop 100,000 h.p. at Chelsea Falls by constructing a dam eight miles north-west of Hull, to cost between $3,000,000 and $4,000,000. At first only half of the total horse-power will be harnessed.

HYDRO-ELECTRIC DEVELOPMENT.—Plans have been prepared for the utilisation of the tides of the Bay of Fundy for the development of hydro-electric energy. The plans at present are for an initial development of 90,000 h.p. at Hopewell, about 20 miles from Moncton at the junction of the Petitcodiac and Memramcook rivers. The rise of the ordinary neap tides there is 32 ft. Mr. W. R. Turnbull, of St. John, New Brunswick, who has studied the problem for many years, proposes to build a compartment dam across the two rivers near the point of junction, which will form two reservoirs. On an hourly drop of 6 in. of water in the available reservoir space, it is thought that 200,000 h.p. could ultimately be developed at Hopewell. The total cost of the initial development of 90,000 h.p. is estimated at $11,000,000.—*Reuter's Trade Service* (Moncton).

The Quebec Government has introduced measures in the Legislative Assembly providing for the expenditure of additional sums for water-power development. An additional $500,000 is required for the development of the St. Maurice river, making the total amount for the purpose $3,000,000, and for the further development of Lake Kenogami, a further sum of $950,000 is required, making a total of $2,750,000.—*Reuter's Trade Service* (Quebec).

It is announced that work will commence this year on the erection of a hydro-electric power station on the Grass river, in far northern Manitoba, 110 miles north-east of The Pas. The plant, which will be the first in the wilderness of the great northland, will be erected to serve the Bingo gold mine.—*Reuter's Trade Service* (Winnipeg).

Continental.—FRANCE.—The French Ministry of Agriculture has recently issued a series of conditions under which it is prepared to subsidise the establishment of power stations for the generation and distribution of electrical energy in country districts purely for agricultural purposes.

RUMANIA.—In connection with the scheme for regulating the River Maros, it is intended to build a large power station which will supply the whole of the Woiwodina and Maros region with electricity. The estimated cost of the scheme is 200,000,000 lei, and provision will be made in the Budget for the year 1925.

Italy.—A proposal has been laid before the Public Works Department at Rome for immediate hydro-electric development on the Upper Adige. Should the Superior Council, now considering the project, arrive at a favourable decision, foreign capital will be invited to participate in conjunction with an Italian technical and financial group from the communities of Meran and Bolzano.—*Reuter's Trade Service* (Rome).

Crediton. — Electricity Supply. — The Urban District Council has received an offer from Exeter City Council for a supply of electricity in bulk to the district, but considers the terms prohibitive. The Electricity Committee has recommended that the Council should provide its own supply and that the clerk should apply for the necessary powers.

Denby and Cumberworth (Yorks.).—Electricity Supply.—The Urban District Council has appointed representatives to confer with the Yorkshire Electric Power Co. with regard to terms for the supply of electricity in bulk in the district. They also ask the company's terms as sole distributors, in order that the Council may come to a definite agreement.

Dundee.—Electricity Extensions.—The electrical engineer has submitted a report to the Electricity Committee on proposed extensions to the power station at Carolina Port. He recommends that one turbo-generator, with switchgear, bunkers, piping, and buildings, be installed at an estimated cost of £202,000. Four boilers were included in the quoted figure as being appropriate, but Mr. Bishop suggests that only two boilers should be installed at the first stage. The anticipated requirement for the extension of mains, sub-stations, switchgear, &c., is £78,000. The Committee has decided to recommend the borrowing of £250,000.

East Lothian.—Progress of Electricity Supply.—The Lothians Electric Power Co. has nearly completed the overhead line to Haddington, and the current will be available in this burgh, as well as in Tranent, as soon as the Edinburgh Corporation has completed its overhead line from Monktonhall sub-station. Residents in Gullane are applying to have the supply extended to the district.

Folkestone.—Proposed Purchase of Undertaking.—The Town Council has appointed a committee to consider the question of purchasing the electricity undertaking of the Folkestone Electricity Supply Co., Ltd.

Hoylake and West Kirby.—Electricity Charges.—The Electricity Committee has decided that new consumers outside the area of the Council be charged an additional 1d. per kWh for lighting and an additional ½d. per kWh for all other purposes.

Special Order.—The Urban District Council is applying to the Electricity Commissioners for a Special Order authorising it to supply the parish of Grange with electricity for both public and private use. As similar Orders are being applied for by the Wirral Rural District Council and the Neston and Parkgate Urban District Council, the Law Clerk has been instructed to oppose the applications of these authorities.

Irish Free State.—Dublin.—At a special meeting of the Corporation on February 25th, a resolution was passed opposing the following Bills, notice of the promotion of which, in the present session of the Oireachtas has been given:—The Dublin Electricity Supply Bill; the East Leinster Electricity Supply Bill; the Irish Hydro and Peat Electric Power Bill. It was also resolved to promote a Bill in the first available session of the Oireachtas including the following proposals:—(1) To utilise the water power of the River Liffey for the generation of electricity; and (2) To supply electricity to local authorities in or adjoining the counties of Dublin, Wicklow, and Kildare.

Kettering.—Loan.—The Urban District Council is applying to the Electricity Commissioners for sanction to a loan of £40,000 to carry out the electricity scheme, for which an Electricity Order has already been granted.

Letchworth.—Special Order.—The Electricity Commissioners have submitted to the Ministry of Transport for confirmation a Special Order made by them authorising the First Garden City, Ltd., to supply electricity in the Urban Districts of Letchworth and Baldock, and certain parts of the Rural District of Hitchin.

London.—Poplar.—The Electricity Committee has recommended to the Borough Council that application be made to the Electricity Commissioners for sanction to the borrowing of £20,798 for mains and £28,125 for machinery.

Luton.—Special Order.—Application has been made to the Electricity Commissioners by the Corporation for a Special Order authorising it to supply electricity in the borough of Dunstable, the urban districts of Leighton Buzzard, Bletchley, Linslade, Hitchin, Letchworth, Baldock, and Stevenage, the rural districts of Luton, Eaton Bray, Wing, and Hitchin, and parts of the rural districts of Ampthill, Newport Pagnell, and Hemel Hempstead.

Madagascar.—Electricity Schemes.—There are now four towns on the island which have a supply of electricity for lighting and power purposes, *viz.*, Tananarivo, supplied by the Société d'Energie Industrielle; Diego-Suarez, supplied from the Laudié works; Maevatanava, supplied by the Compagnie Occidentale; and Antsirate, where a municipal undertaking was inaugurated in April last year. The municipal authorities of Tamatave and Majunga are reported to be raising loans for the establishment of generating stations in their respective towns, the establishment of that in Tamatava having already been commenced. It is also proposed to extend the undertaking at Diego-Suarez by establishing a station to utilise the Menasaka Falls in the district.

Millom (Cumberland).—Electricity Supply.—The Urban District Council proposes to introduce electric lighting in the district, and has requested Messrs. Merz & McLellan to prepare a scheme.

Northern Ireland. — Belfast.—The Corporation's claim against the British Government for the excess cost of the new harbour power station has been settled for £150,000. The work was proceeded with during the period of the war on the understanding that the Government would refund the extra expenditure which was thus incurred.—*Financier.*

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

St. Albans and Harpenden.—*North Metropolitan Electric Power Supply Co.*—Lighting. Flat rate: From 8d. to 7d. per kWh. Maximum demand rate: From 10d. and 4d. to 10d. and 2d. Power: From 33⅓ per cent. to 25 per cent. above the pre-war rate.

Bognor.—*The Bognor Gas Light and Coke Co.*—Lighting: A reduction of 1d. per kWh.

Ringwood.—Special Order.—The Ringwood Electric Supply Co. has applied to the Electricity Commissioners for a Special Order authorising it to supply electricity in the rural district.

Romsey.—Electricity Scheme.—Messrs. Christy Bros. and Co., Ltd., of Chelmsford, have submitted a proposed electricity scheme for the district to the Town Council, and the Council has decided to obtain the advice of an electrical expert on the scheme.

Saddleworth (Yorks.).—Electricity Supply.—The Urban District Council is applying to the Stalybridge, Hyde, Mossley, and Dukinfield Joint Board for a supply of electricity to the district. Application was made in 1922, but the Board stated that it was unable to give a supply until the new power station was erected at Stalybridge. Sanction has now been obtained to carry out this scheme.

South Africa.—Kokstad (Cape Province).—Tenders having been accepted for the electric lighting installation, it is expected that the light will be available by August next.

Lydenburg.—The Municipal Council has adopted a report submitted by Mr. G. A. Stewart on a proposed electricity scheme for the town. The plan includes the construction of a weir on the river above a waterfall on the farm Nooitaldacht, and a canal 4,600 ft. in length, to bring the water to the top of the fall, whence the water will be conveyed to the power station by means of pipes. Two 100-kW generating sets are are to be installed at the station, and electricity will be generated at 230 V. By means of overhead lines the current will be transmitted a distance of 7½ miles to the town. The cost of the scheme is estimated at £16,456, and application has been made to the Electricity Commissioners for sanction to carry out the work.

Bloemfontein.—The Electricity Commission has sanctioned the Bloemfontein municipality's scheme for the erection of a new power station at a cost of £150,000. The provincial administration has now approved the raising of the necessary loan, which has already been sanctioned by the ratepayers.—*The Times.*

Swansea.—Electricity Extensions.—The Town Council has received a request from the Great Western Railway Co. for an additional supply of electricity to the docks, and the electrical engineer has been instructed to lay a new cable so as to increase the supply to 4,000 kVA by next winter. When the work is completed the docks will be taking 15 million kWh per annum.

Torquay.—Electricity Charges.—The Corporation has introduced the following scale of electricity charges as from March 31st next:—Lighting, heating, cooking, and domestic supplies: A quarterly standing charge of 3s. 9d. for each 40-watt lamp or its equivalent, plus 1½d. per kWh. Consumers who do all their cooking by electricity are allowed a special discount of 10 per cent. on the value of all energy consumed for any domestic purpose. Flat rate. Lighting: 10d. per kWh. Heating and cooking: 1½d. per kWh, plus a meter rent of 12s. 6d. per quarter for the winter quarters and 8s. 4d. for the summer quarters. Power: A quarterly standing charge of 12s. per horse-power. Subject to a minimum quarterly charge of 3s. 4d., the total charge to any power consumer shall not exceed the equivalent of 3¾d. per kWh. For all supplies outside the borough and the Urban District of Newton Abbot, all standing charges will be 10 per cent. greater than the amounts given above.

United States.—Electrical Development.—Preliminary plans for the power station to be erected by the Des Moines Electric Co. near the Chicago, Burlington, and Quincy Railway bridge over the Des Moines river have been completed, and the first portion of the scheme will be commenced shortly. The initial expenditure will amount to $6,000,000, and the ultimate development will involve an expenditure of $16,000,000. The order for one 20,000-kW turbo-generator has been placed, and when the power station is completed the plant will include four more sets of similar capacity.—*Electrical World.*

Uruguay.—HYDRO-ELECTRIC SCHEME.—The National Administrative Council has nearly completed its studies of a scheme for utilising the River Negro for generating electricity, and it is anticipated that the contract for the erection of the plant will be awarded immediately. The cost of the scheme is estimated at 15,000,000 Uruguayan pesos. When completed, the power station will be capable of an output of 120,000,000 kWh per annum. The electrical energy will be distributed for use in Montevideo and surrounding towns.

Weobley.—ELECTRICITY SCHEME.—The Hereford Town Council has applied to the Rural District Council for consent to erect a three-phase e.h.p. 11,000-V overhead transmission line in order to supply electricity to Nieuport Sanatorium. Before giving wayleaves, the Rural Council has asked the Corporation on what terms electricity will be supplied to districts through which the line will pass between Weobley and Nieuport.

Tramway and Railway Notes.

Aberdeen.—NEW TRACK.—The Tramways Committee is to lay a new tramway track at the Links at a cost of £2,500.

Continental.—FRANCE.—The General Council of Upper Savoy has decided on the establishment of a system of electric railways in the department. Work has already been commenced on one line between Annecy and St. Julien, while plans are being prepared for the construction of a line between Annecy and Seyssel. It is also proposed to electrify the railway between Annemasse and Samoens and to construct a branch between Fillinges, Boege, Halière, and Poche.

ITALY.—The Société des Tramways Electriques de la Province de Salerne has recently secured a concession from the Italian Government for the extension of its system between Salerno and Valle di Pompei as far as the Circumvesuviana station on the line of the Società Ferrovia Secondarie Meridionali.

SWITZERLAND.—It is announced from Berne that the Swiss Ministry of the Interior is negotiating with a number of Swiss banks for the raising of a loan of 150 million francs at 5 per cent. in connection with the electrification of part of the State railway system.

Coventry.—LOAN.—The Tramways Committee has recommended the Town Council to apply to the Ministry of Transport for sanction to a loan of £38,500 for tramway reconstruction work.

Failsworth.—OPPOSITION TO BILLS.—The Urban District Council is opposing the Parliamentary Bills of the Manchester and Ashton-under-Lyne Corporations. Both towns are seeking powers to run railless cars.

Glasgow.—TRAMWAY SERVICE STOPPAGE.—Owing to a breakdown at Pinkston power station on February 22nd, the city tramcar service was held up for 20 minutes. The breakdown was attributed to a failure in the circulating water plant.

London.—Preliminary work has started outside Harrow station for the electrification of the Metropolitan Railway from Harrow to Rickmansworth.—*The Times.*

The Highways Committee has submitted to the London County Council a recommendation that 200 additional tramcars be fitted with high-powered motors at a cost of £166,500. The Unemployment Grants Committee has approved of a grant of 50 per cent. of the interest on this amount.

COLLISIONS.—Two collisions occurred between tramcars in Clapham Road on February 25th within a few minutes of each other. Five persons were slightly injured.

Lytham-St. Annes.—NEW CARS.—Ten new double-deck tramcars are shortly to be introduced by the local Council. Double-deck enclosed cars have not previously been used on the Lytham-St. Annes lines.

Manchester.—PROPOSED WEEKLY TICKETS.—The Tramways Committee proposes to introduce weekly tickets on the tramways, and has instructed the general manager to prepare a report on the proposal.

Salford.—TRAMWAY FARES.—At a recent meeting of the Tramways Committee it was decided to reduce the tramway fares by lengthening the stages. The changes will be brought into operation on July 1st.

Telegraph and Telephone Notes.

Radio Printing.—SUCCESSFUL TESTS.—During the voyage of the White Star liner *Olympic*, which arrived at New York from Southampton on February 28th, a trial was made for the first time on shipboard of transmitting radio messages automatically from sea to London so that they could be printed in the General Post Office without human aid. The experiment was successfully achieved at a speed of 90 words per minute at a distance of 700 miles from the land station at Devizes, the printing of the message in London being perfect.—*Financier.*

Rhodesia.—RADIO COMMUNICATION.—The Postmaster-General, in an interview, outlined important Rhodesian radio developments in the shape of communication between Salisbury and Pretoria. The scheme, which is awaiting the approval of the Rhodesian Government, will, it is estimated, cost between £12,000 and £15,000, and should be working in twelve months' time.—*Reuter.*

Sweden.—RADIO MATERIAL FOR THE ARMY.—A measure has lately been introduced into the Swedish Parliament in connection with the provision of new material required for the Army during the next ten years. Included in the items scheduled is a sum of 789,000 kroner (about £478,000) for radio telephone and telegraph material.

The Telephone Service.—STREET KIOSKS.—For a long time past the G.P.O. has been doing its best to induce local authorities in London to permit it to erect street kiosks, but practically all at first found reasons for refusing. The City Corporation, for instance, would not allow kiosks in the main thoroughfares, because of the congested nature of the streets. According to the *Evening News*, it agreed that kiosks might be placed in back streets, but the Post Office says they must be in conspicuous places to be of real use. To get some definite decision, the Post Office circularised the Borough Councils, which referred the question to the Metropolitan Borough Councils Joint Standing Committee. The Committee did not quite like the concrete kiosk of the type which the Post Office has erected in various provincial towns, but the details of the design and terms of agreement between the boroughs and the Post Office have not yet been settled. The immediate plans are for about 150, but the only street kiosks in the London telephone area at the moment are at Amhurst Park, in the Market Place at East Ham, and outside Kew Station. On the other hand, there are nearly 600 in various provincial towns, where difficulties such as arose in London were not encountered.

RURAL FACILITIES.—Demands are being made by the National Farmers' Union for the improvement of postal facilities in rural districts. The council of the Union will also press the Government to investigate the non-opening of all telegraph offices at 8 a.m., and present telephone facilities in rural areas. —*Daily Mail.*

Radio Notes.

Aerials.—A CARDIFF WARNING.—The South Wales Electrical Power Distribution Co. has experienced so much trouble due to radio aerials falling on to its overhead electricity distributing lines that a warning had to be broadcast from the Cardiff station of the British Broadcasting Co., Ltd., on January 1st. In one instance an aerial in course of erection was allowed to fall across a 400-volt overhead power line, but fortunately the safety device in the local sub-station operated and the line was made "dead," otherwise the erectors would have received a severe shock. In addition, inconvenience was caused to many consumers whose supply was thus cut off until the fault was located and removed. The Power Co. has attached a notice to all its overhead line-poles pointing out the danger—a rather roundabout way of getting at the offenders.

Brazil.—RADIO-TELEPHONY.—The Brazilian Minister of Transportation and Public Works has granted to the Companhia Radiotelegrafica a concession to install and use four radio telephone transmitting stations in Sao Paulo, Bello Horizonte, Pernambuco. and Bahia.— *Reuter's Trade Service* (Rio de Janeiro).

Canada.—BROADCASTING.—According to a report issued by the Department of Marine, radio broadcasting has become an important factor in colonisation in the Dominion. "Wireless has robbed prairie farm life of its isolation," reads the report, which states that of 100,000 receiving sets estimated to be in operation throughout the Dominion, more than 60 per cent. are owned on farms. This is especially true in the prairie provinces of Manitoba, Saskatchewan, and Alberta. In Manitoba, the provincial government aids broadcasting through its publicly-owned telephone system. Broadcasting stations in Canada number 38, the report shows, and are located in the principal cities from coast to coast. Investment in receiving sets amounts to more than 2,000,000 dollars. —*Reuter* (Winnipeg).

Educational Broadcasting.—ADVISORY COMMITTEES.—The British Broadcasting Co. has formed a committee to act advisorily with regard to the development of broadcasting to schools. On this committee are:—

Sir Walter Davies, Director of Music for the University of Wales; Sir Benjamin Gott, Secretary of the Middlesex Education Committee; the Rev. D. J. Thomas, representing the Association of Educational Authorities; Mr. Gordon Wilson; Mr. G. D. Dunkerley, of the Secondary Schools Association; Mr. A R. Pickles, Director of Education for Burnley; and Mr. P. Sharp, Director of Education for Sheffield.

The result of investigations in various parts of the country among elementary and secondary schools is that it has been decided to undertake a series of six experimental educational transmissions from each of the British broadcasting stations between 3 and 4 p.m. on successive Fridays and in the London area will begin in a month's time. In order to assist development, local education committees are being formed in each broadcasting centre.—*The Times.*

Reception on Trains.—Further Experiments.—It is reported that following the recent G.W.R. tests, Pullman cars on the L.N.E., L.M. & S., and Southern Railways are to be fitted with radio receiving sets. The Great Western demonstration was arranged by Mr. Colin H. Gardner, managing director of the Midland Radio Telephone Manufacturers (Stourbridge) and Midlands organiser of the Radio Society of Great Britain. The experiments were conducted by means of a "Mellowtone" set employing two high-frequency, one detector, one note-magnifier, and two power-amplifying valves—an exact replica of the sets made commercially by the Midland Radio Telephone Manufacturers. An aerial of the twin wire type, using 50 feet of rubber-covered "flex," was suspended about a foot below the roof of the brake van, and the earth wire was carried to the vacuum brake and thence through the wheels to the rails. Singularly little trouble was experienced from the generator hum of the train lighting apparatus, nor did the slight rocking of the train when travelling at high speed affect the tuning of the set. The success has been such that the installing of a permanent set on the Cornish-Riviera express is now contemplated.

Relay Stations.—New Yorkshire Station.—It is understood that a relay station of "super-efficiency" is to be erected at Rawdon, Yorkshire. The new station, besides serving Leeds and other centres, will supplement the service provided by the Sheffield station.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review in which the "Official Notice" appeared in our advertisement pages.)

Open.

Argentina.—April 23rd. Sanitary Works Department. Electrically-driven centrifugal pumps. Ref. 6,084/25/FL/EC2 (a).*

Australia.—Melbourne.—April 2nd. Victorian Railways. Metal- and carbon-filament lamps for electric train lighting.*

Sydney.—April 9th. N.S.W. Government Railways and Tramways. Electric overhead travelling crane. Ref. 13,139/ED/EC2.*

May 7th. One 30-ton electric overhead travelling crane; one 15-ton ditto.

May 21st. Electric railway car equipment for 150 motor-cars and 150 trailer cars, consisting of motors, controllers, air compressors, pantographs, and accessories.*

March 27th. Postmaster-General's Department. Signal cable and insulated wire. (Schedule N.S.W. No. 69).*

Brisbane.—April 9th. Brisbane Tramway Trust. Fifty 50-h.p., 500-V, d.c. traction motors; 30 ditto, 60 h.p., or, alternatively, 80 60-h.p., 550-V, d.c. traction motors, with 15 sets of control equipment and spare parts.—*Reuter's Trade Service* (Melbourne).

Barrow-in-Furness.—March 17th. Electricity Department. One water-tube boiler, with two chain or travelling grate stokers; removal and re-erection of two Babcock & Wilcox boilers; e.h.p. steel cubicle switchgear; one automatic voltage regulator. (February 29th.)

Bedford.—March 14th. Electricity Department. E.h.p. h.p., and l.p. underground cables for 12 months. (February 29th.)

April 1st. Electricity Department. One 3,750-kW single-phase turbo-alternator, with condensing plant. (See this issue.)

Belgium.—March 18th. Deputation Permanente de la Province de Limbourg. Sixty static transformers, 20 ditto for aerial posts, with accessories, 120 step-up transformers and 120 potential transformers, with accessories; and 60 three-phase, three-wire electricity meters and 15 exterior-type meters. The specifications may be inspected at the Bureau du Service, Provincial d'Electricité, 27, Avenue Bamps, Hasselt.

Bexley.—Urban District Council. Electricity Department. Supply and installation of a 33,000-V, 3-ph. main transmission line consisting of 3,300 yd. of .15 three-core cable in duplicate. (February 29th.)

Croydon.—March 15th. Board of Guardians. Six months' supply of electrical appliances, &c. Mr. N. F. Walker, clerk to the Guardians, Union Offices, Mayday Road, Thornton Heath.

Dearne.—March 24th. Electricity supply: Electric cables; sub-station switchgear; electricity meters; three-phase transformers. (See this issue.)

Dundonald.—Lochgelly Iron and Coal Co., Ltd. Various works, including electric lighting, required in the erection of 40 houses, and a new street. Schedules from Mr. A. D. Hoxton, architect, Leven.

East Ham.—March 10th. Electricity Department. Two 1,000-kW converters, one lighting feeder booster, one l.p., d.c. switchboard, two 6,600-V switchboard panels, e.h.p. and l.p. cables, and water-cooling plant. (February 22nd.)

Edinburgh.—March 15th. District Board of Control. Renewal of electric cable at the Bangour Mental Hospital. Mr. Jas. D. Gibson, surveyor, 60, Frederick Street, Edinburgh.

Electrical work at East Craigs Seed-testing Station, Corstorphine. Chief surveyor, Board of Agriculture for Scotland, York Buildings, Queen Street, Edinburgh.

Egypt.—Cairo.—March 25th. Ministry of the Interior. Pumping plant, including pumps, tubing, electric motors, transformers, switchboards, cables, &c. Ref. 12,491/FE/EC (2).

April 17th. Electric power station and distributing system.*

Fife.—March 11th. Education Authority. Electric lighting in connection with extensions at Education Offices at Wemyssfield, Kirkcaldy. Schedules from Education Office.

Glasgow.—March 10th. Corporation. Electrical installation at medical superintendent's residence, Belvedere Hospital. Public Works Department, City Chambers.

Halifax.—March 18th. Board of Guardians. Electrical fittings for six months ending September 30th, 1924. Mr. A. T. Longbottom, clerk to Guardians, Union Offices, Carlton Street, Halifax.

Hornsey.—March 14th. Electricity Department. One 15-ton crane. (February 29th.)

Kettering.—March 24th. Electricity Department. Two l.p. armoured lead-covered feeder cables. Two feeder pillars. (See this issue.)

Leeds.—March 29th. Electricity Department. One 12,000-kW turbo-alternator set, and steam turbine-driven surface condensing plant. (February 15th.)

London.—Southwark.—March 20th. Board of Guardians. Installation of electric lighting at the Newington Institution. (February 29th.)

Metropolitan Water Board.—April 23rd. Two 25-kW steam-driven electric generators, switchboard, piping, &c., at Littleton pumping station; and one 150-kW steam-driven electric generator; switchboard, piping, &c., at Walton pumping station. (See this issue.)

Manchester.—March 11th. Tramways Committee. Steel tramway poles; span wire brackets for tramway poles; copper and bronze trolley wire. Mr. H. Mattinson, general manager, Corporation Tramways, 55, Piccadilly, Manchester.

Marlborough.—Town Council. One 100-kW oil engine-driven d.c. generator, feeder, booster and switchboard; underground mains; house meters. (See this issue.)

Portsmouth.—March 19th. Board of Guardians. Electrical fittings for three months. Mr. H. C. Morrell, clerk, St. Mary's Road.

Radcliffe.—Electric light installation, St. Paul's Wesleyan School, Amsworth Road. Mr. Wm. Marsh, 46, Starling Road.

Rhondda.—March 31st. Electricity Department. A.c. house service meters, cables, joint boxes, &c., for 12 months. (See this issue.)

Southampton.—March 26th. Electricity Department. One 1,000-kW rotary converter set with transformer and starting panel. (See this issue.)

South Africa.—Johannesburg.—March 24th. Municipal Council. Oil switches.*

Trowbridge.—March 27th. Trowbridge and Melksham Union. Electric lighting installation at the Institution, Semington, Trowbridge. (February 29th.)

Uruguay.—Montevideo.—April 30th. State Electricity Supply Works. Six generating sets, complete with accessories and spares, consisting of Diesel oil engines and generators directly coupled.*

West Ham.—March 17th. Education Committee. Electrical wiring for 12 schools. (February 29th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Aberdeen.—The Tramways Committee has considered tenders for overhead equipment, including poles, fittings, cables, &c., for the Hazelhead extension. The British Mannesmann Tube Co., Ltd., has obtained the principal contracts.

Atherton.—South Lancashire Tramways Co. Accepted:—

Two boilers, with super-heaters, economisers, chain-grate stokers, fans, &c.—Clayton & Shuttleworth, Ltd.

Australia.—Brisbane.—Tramway Trust.

Ten miles of tram rails.—Dorman, Long & Co.—*Reuter's Trade Service* (Melbourne).

Belgium.—Keen international competition was experienced last week in the case of a small contract for the supply of 500 metres of armoured cable required by the municipal authorities of Schaerbeek, Brussels. No fewer than ten tenders were received, four being from Belgian firms, and one each from France, Holland, Germany, Denmark, Czecho-Slovakia, and Great Britain (Callender's Cable and Construction Co., Ltd.). The lowest offer was that of the Société des Ateliers de Constructions Electriques de Charleroi.

Four Belgian and one Swiss concern last week submitted tenders to the municipal authorities of Schaerbeek for the supply of 1,000 5-amp., 110-V., a.c., single-phase electricity meters. The lowest offer was that of La Société Continentale des Compteurs, of Brussels, who quoted 50 fr. each.

(Continued on page 383.)

The Underground Railway Overhaul Works.

New Repair Shops at Acton Town.

OWING to the increase which has taken place in the number of cars in use and the car mileage run, the existing repair shops originally built by each of the London electric underground and tube railway companies became inadequate to maintain the rolling stock in good order. In December, 1920, it was therefore decided to provide central workshops to deal with the overhauling of the whole of the rolling stock of the Metropolitan District, London Electric, City and South London, and Central London Railways.

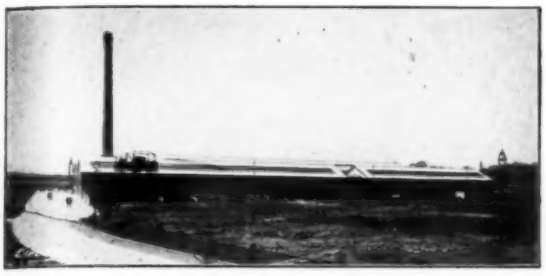


Fig. 1.—Acton Overhaul Works.

About 30 acres of land was purchased near Acton Town station, and the first portion of the new works was brought into use in December, 1922, sufficient equipment being provided to undertake the periodical overhaul of the District, Bakerloo, Piccadilly and Watford joint stock. Later it is intended to extend the workshop to permit of the overhaul of Central London, Hampstead, and City and South London rolling stock and the concentration of all car-painting and body-repair work, together with the repair and manufacture of engineering stores and supplies required in the mechanical department of the allied railways; additional land is being obtained for such extensions. About 500 men are employed at the present time, overhauling 16 cars a week, which nearly covers the needs of the District, Piccadilly, and Bakerloo lines, also undertaking the stores manufacturing work for the outlying depôts.

It was decided to give a trial to a "progressive system," in which each vehicle moves forward in stages until the overhaul is completed, but as railway cars are too large and heavy to allow travelling platforms to be used economically, special "accommodation bogies" have been designed on which the car bodies are placed after withdrawal of the service bogies, the car body thus remaining mobile, being moved from stage to stage by means of electric traversers and capstans.

The plan reproduced in fig. 15 shows in heavy full lines the main shop as it is at present. The total covered area of the shops when completed will be 10 acres, the area of the works and yards being 28.43 acres. It is estimated that stage 1 will be sufficient to deal with 30 cars per week, and stage 2 will deal with 60 cars per week.

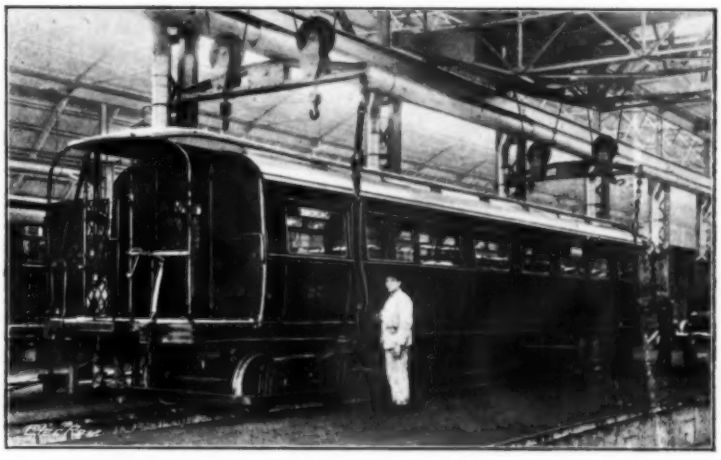


Fig. 3. Four-point Two-crane Lift.

Fig. 2.—Truck Department.

The main shop consists of one building 400 ft. long by 250 ft. wide under one roof, and is divided without walls into four main sections.

The truck department, fig. 2, is served by two overhead travelling electric cranes, figs. 3 and 4, made by Craven Bros., each of 15 tons capacity. Cars for overhaul pass from the inward sidings to the dismantling section by means of a 45-ton electric traverser, fig. 5, from which they are moved on to dismantling pits at one end of the truck bay by means of an electric capstan. After the trucks have been disconnected from the car body, the latter being lifted by means of the two overhead cranes, the bogies are withdrawn towards the truck-dismantling section. The body is then lowered on to two accommodation bogies, and is drawn out again on to the electric traverser by means of the cap-

stan to be transferred to the car body department. The bogies are next dismantled by means of the overhead cranes, the various parts passed through the washing tanks (a special washing machine with travelling chain

Fig. 4.—Double-point Crane Lift.

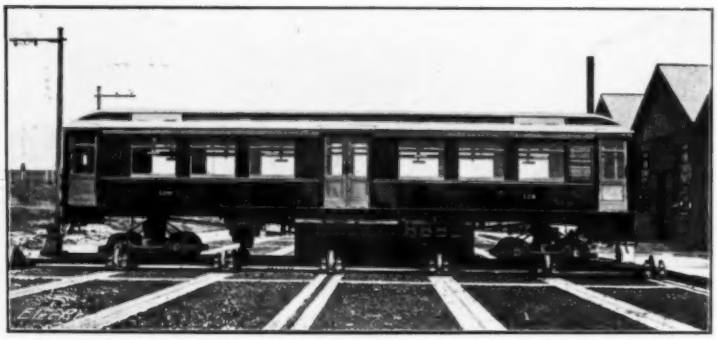


Fig. 5.—Electric 45-Ton Traverser.

floor is being provided to replace these tanks), and the parts are then passed to the particular department which executes the necessary repairs on them. The motors are transferred complete by means of electric battery trucks (fig. 6 illustrates one of the several types used) to the motor section for overhaul. The truck frame, after cleaning, is conveyed by the overhead cranes to one of 35 stances provided in the frame repair section. At the other end of the truck bay is the assembly section, wherein the process is the reverse of that described, the overhead cranes being used for lifting and an electric traverser (a duplicate of the one used at the inward end of the shop) to transfer the car body from the body to the truck departments. After the car has been checked, it is passed out across the traverser to the inspection and finishing shop, where the current-collecting gear is erected, and electric and brake connections are made and tested. After testing, the car is again passed on to the electric traverser, which conveys it to outside sidings from which it leaves the works.

The car body and electrical equipment department consists of five sections. The car body section allows the trailer cars, which require a shorter time for overhaul, to pass through the shop at a quicker rate than the motor cars. The cars enter from the electric traverser, and are moved forward in stages by means of electric capstans. The time taken for a car to pass through this section is six days in the case of a motor

Fig. 6.—Orwell Electric Truck.

car and four days in the case of a trailer car. The work done in the various stages is as follows in the case of motor cars:—H.p. testing, stripping control equipment, and compressor; overhauling electrical fixtures and making good defects found during h.p. testing; re-fitting compressor, contactors, final adjustments, and test control; inspection and insulation tests.

In the case of trailer cars it is: H.p. testing, inspection of bus lines and connection boxes; overhauling switch panels, making good defects found during h.p. testing; overhauling heating and lighting circuits; inspection and insulation tests. The overhaul of the body structure, fittings, &c., is carried out during the progress of the car through the various stages. On arrival at the exit, the car is passed

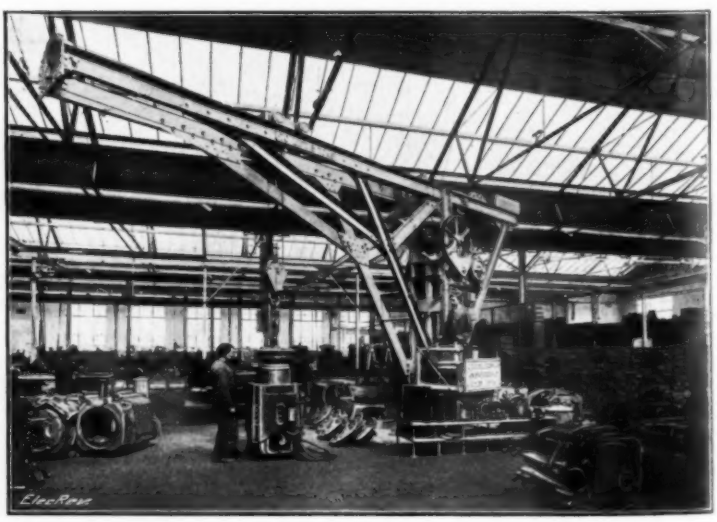


Fig. 7.—A 3-Ton Booth Electric Jib Crane.

on the electric traverser to the assembly section of the truck department.

Complete motors are brought from the truck department to the motor dismantling area by means of electric

battery trucks; they are then dismantled under a three-ton electric jib crane, fig. 7, of 20-ft. radius, made by Messrs. Joseph Booth, Ltd. Electrically-driven plant within the radius of the crane is provided to blow out the dust from the armature and motor case by compressed air, and an exhaust fan, driven by a 20-h.p. electric motor draws the dust into a special tank provided with water baffles where it is deposited. The armature is then passed to the armature repair shop, which is provided with an overhead run-way with compressed-air hoists to facilitate the movement of the armature to the various machines and stands where the repairs are carried out. Special machines are provided for commutator turning (fig. 8), keyway cutting, commutator slotting, and armature binding, also stands for winding, enamelling, &c., the armature passing in rotation to each machine or stand, and finally being placed on a truck (accommodating seven armatures), on which it is passed through a stoving oven, fig. 10; it then comes under a second 3-ton electric jib crane of 16-ft. radius made by Messrs. Joseph Booth Ltd., which serves the motor assembly area, where it is tested before assembly in the case. In the meantime the motor case and field coils have been repaired.

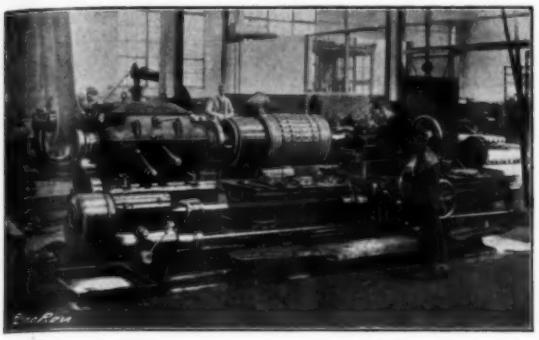


Fig. 8—Dean Smith and Grace Armature Turning Lathe.

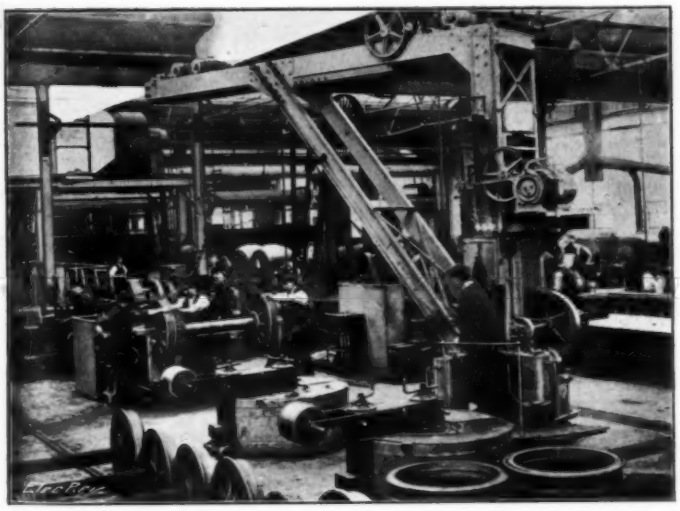


Fig. 9.—Wheel Turning Area, with Gibbons Crane and Oerlikon Electric Tire Heaters in Foreground.

In the electrical equipment section the different unit parts are dealt with by the fitters on benches allocated for the work, and the equipment is transferred from and to the sections as complete car sets.

The compressor section is provided with stands over which is an overhead runway with hoists. Compressor armatures and field coils are sent to the motor section to be dealt with. All compressors are given a running test under working conditions before dispatch to the body section for mounting on the underframe.

Fig. 10.—Armature Oven.

In the brake section, after leaving the fitters' benches the complete equipment is tested under normal conditions before being passed to the body section for mounting in the cars.

In the smithy and wheel and axle department the smiths' section carries out repairs to brake gear, bogie parts, springs, &c. The equipment comprises eight down-draught and nine up-draught hearths (five of which are served by 10-cwt. jib cranes), two 7½-cwt. motor-driven pneumatic hammers, one 5-cwt. motor-driven pneumatic hammer, two upsetting and welding machines, one motor-driven punch and shears, one twin chamber spring furnace, and one spring-testing machine; the latter is novel and was designed for testing springs for load deflection and "scragging." A motor-driven variable-stroke rotary pump provides the power, oil being the working agent.

Fig. 11. Electric Gantry Crane.

Blast for the hearths is provided by two motor-driven fans, and a motor-driven exhaust fan is provided for the down-draught hearths. An electric welding area is attached to the smiths' shop. The building-up of worn parts is undertaken by means of three sets of single-operator plant of the differentially-wound generator type. The use of electric welding is being extended, it being found possible economically to relieve the smiths' shop by this means. Provision is also made in this area for Thermit-welding certain parts which cannot be dealt with by the electrical plant.

Fig. 12.—Drilling Section.

In the wheel and axle section, the tire and axle area contains two motor-driven hydraulic presses, each of 200 tons capacity, served by a 35-cwt. electric jib crane made by Messrs. Gibbons Bros.; these are provided for pressing wheel centres and gear wheels on to the axles. Five vertical boring mills are used, being fed by three compressed air cranes designed and built at Acton. The bored tires are expanded in two electric induction heaters, fig. 9, and then shrunk on to the wheel centres, a 35-cwt. electric jib crane made by Messrs. Gibbons Bros. being provided for lifting purposes. Other special plant in this area comprises hydraulic rolls for rolling down retaining rings, a horizontal drilling machine for drilling motor tires after they have been shrunk on to the wheel centre, and an axle journal returning and burnishing lathe provided with two special tool rests for cutting out retaining rings. These three machines are all driven by independent electric motors, and the last two were specially designed.

The wheel-turning area contains four lathes, each driven by an independent electric motor. Two of these machines are equipped with 50-h.p. motors and contactor starters, and a 3-ton overhead travelling crane feeds the lathes.

The bearing area is equipped with gas furnaces with automatic temperature control, and an oven, having a moving chain bottom, is used for melting out old metal from bearing shells and for heating the shells and mandrels preparatory to re-metalling.

Fig. 13.—Buffalo Forge Heating Plant.

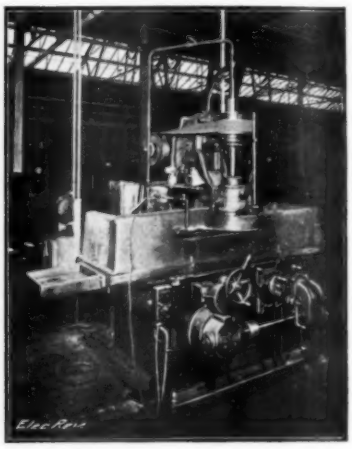


Fig. 14.—Churchill Magnetic Surface Grinder.

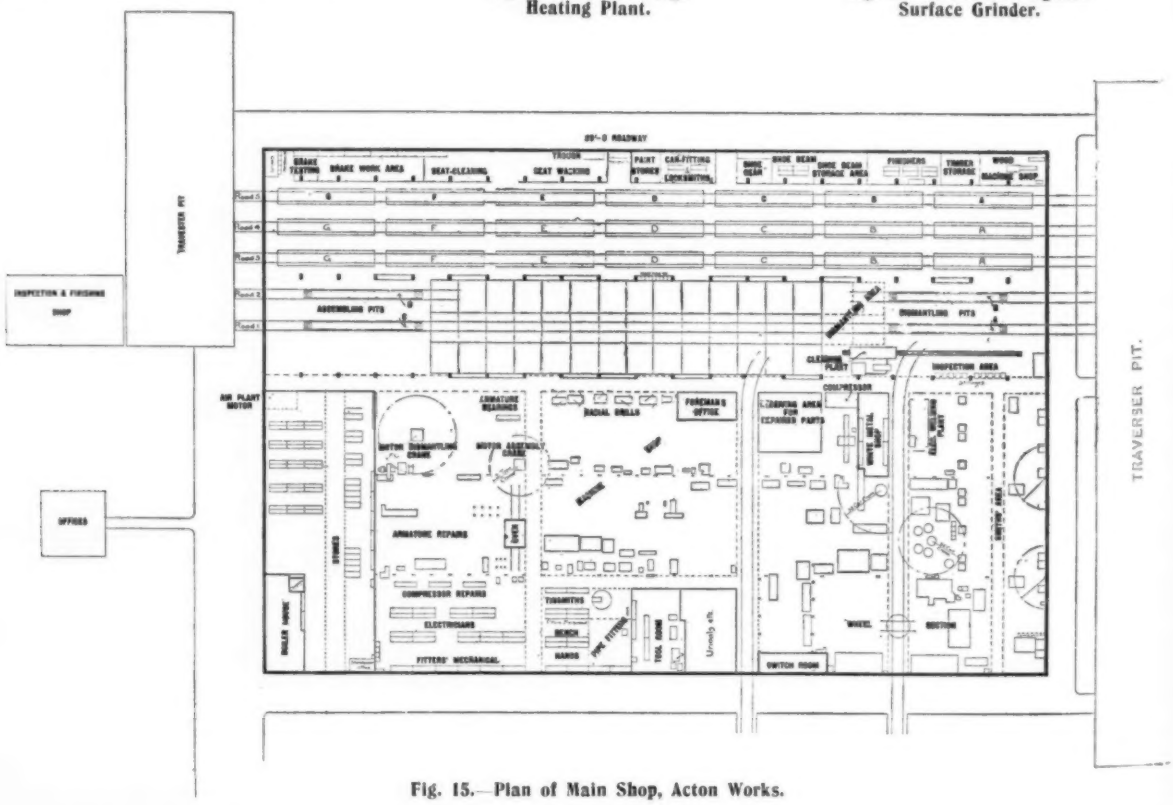


Fig. 15.—Plan of Main Shop, Acton Works.

The machine and fitting department is equipped with electrically-driven machine tools of the most modern design, and by the use of stillages, material is handled

only twice instead of four times, which would be the case if ordinary trucks were used. A tool room, attached to this section, provides tools for the whole of the machines used in the works, which are electrically-driven throughout, some by individual motors and others by belt shafting, according to the requirements of the process. Fig. 14 illustrates a typical machine tool.

Heating.—A special feature has been made of the heating and ventilating of the works. The plenum system is employed, there being three heating units. Air is drawn through an inlet cowl on the roof by means of a motor-driven fan, fig. 13, circulating through three series of live steam pipes, and exhausted through ducts leading to the various parts of the shop. Thermometers are placed in various positions throughout the works, and an attendant registers the temperature every two hours, adjusting the steam supply so as to maintain an even temperature of about 55 deg. F.

The stores are situated inside the works, a system of loose containers being used for the storage of raw materials and spare parts. Heavy materials are stored in concrete dumps outside the works. A 3-ton electric gantry crane, fig. 11, serves these dumps, as also the wheel park and scrap dumps. Materials can be loaded to or from road or rail by means of this crane.

Auxiliary buildings, comprising administrative offices, oil, petrol, carbide and waste stores, ambulance room, cycle shed for 100 machines, and spare parts stores, are provided, as is also a canteen for the employés, with ample seating accommodation for 400 men.

Power Supply.—Alternating current is provided for lighting and for certain special purposes, such as tire heating, rivet heating, pipe bending, &c., and is obtained from the transformer house at the London General Omnibus Co.'s adjacent Chiswick works. Direct current is provided from the Acton Town railway sub-station, a special main being laid to the works switch room. Provision has also been made, in case of necessity, for switching over on to the yard tracks.

Lighting.—Special attention is being given to the lighting, the idea being to obtain a good general light rather than to have a number of local lights. Certain machines are provided with local lights, as are also a certain number of benches, where the work is of a more delicate nature.

Contracts Closed.

(Continued from page 378.)

Bradford.—Tramways Committee. Recommended:—
Supply of six one-man railless electric trolley cars (£9,200).—Associated Equipment Co., Ltd.

Board of Guardians. Accepted:—
Electric lighting installation at Daisy Hill Institution (£379).—Mr. Charles Bell.

Bury (Lancs.).—Town Council. Accepted:—
Alterations to the sewage works:—
Motors and equipment.—Electric Construction Co.
Electric mains.—Corporation Electricity Department.
Recorder.—Lea Recorder Co.
Surface-aeration plant and pump.—Ames Crosta Sanitary Engineering Co.

Lancaster.—Electricity Committee. Accepted:—
Transformers for sub-stations (£1,151).—Ferranti, Ltd.
H.p. switchgear.—A. Reyrolle & Co., Ltd.

Leyton.—Urban Council. Accepted:—
1,000-kW motor converter (£4,505).—Bruce, Peebles & Co., Ltd.
Switchboard extensions (£181).—Reyrolle & Co., Ltd.

London.—FULHAM.—Borough Council.—The Council on Monday decided to accept the tender of the Metropolitan-Vickers Electrical Co., Ltd., at £131,000, for plant for the extension of the electricity system. A Swiss tender was submitted at £12,000 less. The proposal to accept Messrs. Metropolitan-Vickers' tender received the approval of all sides of the Council. For the Labour members, Alderman Terry pointed out that although it was what Liberals might regard as a question of Free Trade, they had to consider that there was to be employment of British workers. The contract provided that every part was to be of British manufacture, and the other firms tendering could not give that guarantee.

Sutton (Surrey).—Urban Council. Accepted:—
Electric plant for the sewage works (£606); special pipes and valves (£42).—Hugh Wood & Co.

Windsor.—Board of Guardians. Accepted:—
Engineering services, including electric lighting and power, at the Institution (£5,245).—Barford & Perkins, Ltd.

Forthcoming Events.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, March 8th. At the South Wales Institute of Engineers, Cardiff. At 5.30 p.m. Paper on "The Construction and Design of the Brush Ljungström Turbine," by Mr. W. Pearson.

Salford Technical and Engineering Association.—Saturday, March 8th. At the Royal Technical College. At 7 p.m. Paper on "Colloidal Treatment of Boiler Feed Water," by Mr. H. W. Bannister.

Royal Institution of Great Britain.—Saturday, March 8th. At 21, Albemarle Street, W. At 3 p.m. Lecture on "Properties of Gases in High and Low Vacua," by Sir Ernest Rutherford, F.R.S.

Northampton Engineering College, Engineering Society.—Monday, March 10th. At the Institute, St. John Street, E.C. At 5.30 p.m. Paper on "Torsion Meters," by Mr. J. Ward.

Edinburgh and Lothians Electricity District.—Monday, March 10th. At 10.30 a.m. City Chambers, Edinburgh. Commissioners' Inquiry.

Royal Society of Arts.—Monday, March 10th. At John Street, Adelphi, W.C. At 8 p.m. Cantor Lecture: "A Study of the Destructive Distillation of Coal," by Mr. E. V. Evans. (Lecture IVI.)
Wednesday, March 12th. "Personal Recollections of Some Notable Scientific Men," by Mr. A. A. Campbell Swinton, F.R.S.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, March 10th. At the Institution, Victoria Embankment, W.C.2. At 7 p.m. Discussion on "The Work of the International Conference on E.h.p. Lines," held in November, 1923, to be opened by Mons. J. Tribot.

(Scottish Centre).—Tuesday, March 11th. At the North British Station Hotel, Edinburgh. At 7 p.m. Paper on "The Design of Apparatus for the Protection of a.c. Circuits," by Mr. A. S. Fitzgerald.

(Scottish Students' Section).—Friday, March 14th. At the Royal Technical College, Glasgow. At 7.30 p.m. "Rotary Converter Notes, including Automatic Control," by Mr. E. T. Pounds.

(South-Midland Centre).—Thursday, March 13th. At the University, Birmingham. At 7 p.m. Ordinary meeting.

(North-Eastern Centre).—Monday, March 10th. At Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Lecture on "Some Observations on Distortion in Radio-Telephony," by Mr. W. D. Owen.

(Irish Centre).—Thursday, March 13th. At Dublin. Paper on "Small Power Supply Schemes," by Mr. J. A. Kenny.

(East-Midland Sub-Centre).—Tuesday, March 11th. At University College, Nottingham. At 6.45 p.m. "Some Notes on the Distribution of Electrical Energy," by Mr. A. D. Phillips.

(North-Midland Students' Section).—Tuesday, March 11th. At the University, Leeds. At 7.30 p.m. Paper on "Railway Electrification," by Mr. A. J. Sayers.

National Association of Supervising Electricians.—Tuesday, March 11th. At St. Bride's Institute, E.C. At 7 p.m. Lecture on "Electric Driving of a Modern Factory," by Mr. F. W. Smith.

Greenock Association of Electrical Engineers.—Wednesday, March 12th. At 22, West Stewart Street. At 7.45 p.m. Business meeting.

Institute of Metals.—Wednesday and Thursday, March 12th and 13th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 10.30 a.m. each day. Annual meeting.

Junior Institution of Engineers.—Friday, March 14th. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "Water-tube Boilers," by Mr. L. M. Jockel.

Electro-Harmonic Society.—Friday, March 14th. At Caxton Hall, Westminster, S.W. At 8 p.m. Smoking concert.

Institution of Engineers-in-Charge.—Saturday, March 15th. At the Holborn Restaurant, W.C. At 6 p.m. Annual dinner.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names of makers or suppliers of:—

ULESTER electric fans.
GIBSON patent terminals.
MARCO lighting sets.

Notes.

New Plug Switch.—Mr. F. G. W. Tree, charge engineer of the Glasgow Corporation, is applying for a patent for a safety device he has invented for use in connection with plugs for lighting and power purposes. The inventor claims that his device will prevent accidents and short-circuiting, since immediately the plug is withdrawn the current will be switched off automatically, rendering an auxiliary switch unnecessary.

Cables for Automobiles.—British Standard Specification No. 5,002/1924 gives the dimensions of lighting and starter cables for system pressures of 6 and 12 V nominal, but does not deal with the composition, quality, or durability of the insulating material used as the dielectric. The specification is divided into seven sections, four of which deal with various types of lighting cables, the remaining three being concerned with starter cables, the dimensions being given both in inches and millimetres throughout. Three types of covering are included for both classes of cable, namely (*a*) braided and compounded, (*b*) metallic armoured, and (*c*) cab-tire sheathed. Copies of the specification may be obtained from the B.E.S.A. Publications Department, 28, Victoria Street, S.W.1, price 1s 2d., post free.

Local Societies.—TOWN DISTRIBUTION SYSTEM.—At a meeting of the Paisley Association of Electrical Engineers on February 26th, Mr. H. Wilson, of the Paisley Electricity Department, lectured on the "Design of a Town Distribution System," starting with the assumption that electricity had to be supplied in a hitherto undeveloped district. He advocated the adoption of an alternating-current system, and, with the aid of lantern slides, demonstrated the relative losses resulting from various systems of distribution, and outlined the general arrangements which he would suggest for a model system. An interesting discussion was opened by Mr. W. Blair Smith, who was followed by Messrs. Humphriss, Bruce, and Adam.—*Paisley Daily Express.*

ELECTRICITY IN MINES.—That new methods are rendering the use of electricity increasingly safe in coal mines was emphasised in a paper by Prof. Douglas Hay and Mr. I. C. F. Stetham, of the Mining Department of Sheffield University, read at a meeting of mining engineers at Sheffield. They pointed out that in many instances the use of protected apparatus was confined to well stone-dusted or otherwise safe main roads, but it would appear that the greater general safety and robustness of flame-proof apparatus justified its use throughout a mine despite its slightly greater cost. In future the risk of danger arising from the use of electricity would be almost negligible. Its extended employment from an economic standpoint was already justified, for it was admittedly by far the most economical and convenient method for the transmission and utilisation of power underground.

"CRYSTALS."—At the meeting of the Croydon Wireless and Physical Society on February 25th, a lecture was given on "Crystals" by Capt. A. Hinderlich, M.A. The lecturer, after briefly reviewing the method of growth of minerals, dealt with each of the "wireless" crystals in turn. He laid special emphasis upon the relative stability of each, estimating their purity (ease of finding good spots), requisite contact pressure (ability to withstand mechanical shock), and hardness (resistance to mechanical wear). Large specimens of some twelve distinct varieties were exhibited to the members.

Localised Lighting.—A firm of textile makers-up in Manchester has adopted a system of localised lighting on its sewing machines, which would be a distinct help to production in many different kinds of factories. At ordinary sewing machines, button-holing machines, and button-sewing machines a not infrequent occurrence is the piercing of the operator's finger by the needle. Overhead lighting is not sufficient, nor is a portable light which causes glare and shadows. What is required is a light with the rays directed on to the needle plate and yet casting no shadows. The firm above mentioned has solved the difficulty by having a neat fixture on each machine which supports what is virtually a small-diameter torch with a bulb at one end. As the torch is at the front of the machine, the operator's eyes are not affected, but the needle plate and mechanism surrounding it are in good light. The cost of installation of these lights was small, and the result has been better work and fewer accidents. A somewhat similar device used for the same purpose can be seen on the stand of the Singer Sewing Machine Co., Ltd., in the gallery of the main hall at the *Daily Mail* Ideal Home Exhibition, Olympia.

Appointment Vacant.—Installation superintendent (£275) for the City of York Electricity Department.

Educational.—COURSES FOR TECHNICAL TEACHERS.—Among the short courses of instruction which are being arranged in the summer by the Board of Education for teachers in technical and evening schools are courses of engineering science and electrical engineering at Oxford and Birmingham. The standard of work in each course will be that of the National Certificates in Mechanical Engineering and in Electrical Engineering. At the same time a course in commercial subjects will be held at Cambridge.

BLAIR SCIENCE FELLOWSHIPS.—At a meeting of the L.C.C. Education Committee in February 26th, the proposal that two Sir Robert Blair Fellowships for applied science and technology be established was agreed to. It was explained that £20,000 balance from work on munitions was available. The fellowships, each valued at £450 for one year, would be open to those engaged in engineering work as well as to those who had completed courses of study with distinction, preference being given to those who completed a course of study in London. The awards will be made by the Education Committee after conferring with the Consultative Committee on Engineering. The latter committee consists of Sir Dugald Clerk, Sir John Snell, Sir Wilfred Stokes, Mr. C. P. Sparks, and Sir Charles Parsons.

Diesel Engine Working Costs.—On February 15th the Diesel Engine Users' Association considered a second report which had been prepared by a committee on the subject of heavy oil engine working costs for the year 1922-23. The report is accompanied by a tabulated list of the actual working costs of 29 Diesel or semi-Diesel installations in the United Kingdom and five Diesel generating stations overseas. The average total engine cost of the 29 home stations, with a total output of nearly 22,000,000 kWh and an average annual plant load factor of 14.8 per cent., was 0.987d. per kWh generated. The individual outputs of the 29 undertakings varied between 195,000 and 2,500,000 kWh in the year. The corresponding figure for the five overseas stations, having a total output of about 11,500,000 kWh, was 0.790d. per kWh generated. The figures were obtained in undertakings in many of which the conditions of working are by no means favourable to obtaining the best results, and they do not represent the results obtainable from installations operating under reasonably favourable conditions. The opinion has been expressed by the committee that in the matter of maintenance costs (including any renewals or replacement of parts besides ordinary overhauling and repair work) it is necessary to work out an average figure of not less than five years in view of the irregular incidence of certain heavy costs, such as those of the renewal of liners, pistons, &c. The committee selected six representative undertakings which have generated during the past six years a total output of over 30 million kWh, and the average maintenance cost per kWh generated over the six undertakings combined for a period of six years was found to be 0.120d. per kWh generated. In this connection it has to be borne in mind that the costs of labour and material were abnormally high during the years 1919 to 1921. Attention is called in the report to the very great variation in the reported consumptions of lubricating oil, greater than can be satisfactorily accounted for after allowing for the influence of load factors and types of engines. In the course of the discussion on the report it was suggested that research work might be carried out with a view to determining what should be the maximum quantity of lubricating oil to use on heavy-oil engines under given conditions of working. A final report embodying any alterations or additions as a result of the discussion will be issued by the Association in due course.

International Conference on Extra-High-Pressure Transmission Lines.—On several occasions in 1922 we drew attention to the report of the first International Conference on E.H.P. Transmission, which took place in November, 1921; the French edition was published at the end of 1922, and was noticed in our pages, but the foreshadowed English edition was never produced, because the number of subscribers was insufficient to justify the expense of production. The proceedings at the second Conference were reported in our issues of December last, and will in due course be published in French; but it is feared that there will again be too few English-speaking subscribers to permit of the issue of an English edition. A review of the contents of the first volume may therefore be of service as a guide to what may be expected of the second.

In addition to general matter, the volume contained particulars of the legislation regarding e.h.p. transmission in Holland, Italy, Japan, Norway, France, Belgium, and Sweden. A full illustrated account of the 110,000-volt system near Barcelona is followed by papers on the interconnection of power systems in Norway, high-pressure distribution in England, and interconnection in the neighbourhood of Boston and Washington, U.S.A., in Italy, Spain, Japan, and France, and reports submitted to the Conference, with verbatim reports of the discussions thereon, dealing with power-house plant, transformers, open-air sub-stations, protective devices, e.h.p. circuit-breakers, transmission-line problems, 220,000-volt apparatus and systems, the construction of lines and masts, underground and submarine cables, insulators, resonance, load factor and cost, regulation of voltage and frequency, surges, reactances, interference with communication lines, earthing the neutral, paralleling, and co-operation with consumers.

The papers are of the highest class, by eminent authorities, and constitute a veritable mine of information; to an engineer engaged on high-pressure transmission, who wishes to be *au fait* with his subject, they must be invaluable. The volume comprises 1,176 pages, and is fully illustrated; at the price of 100 fr., to those who read French, it is a bargain—or was at the time when we announced its issue (December, 1922). As only 150 copies were printed extra to those subscribed for, it is doubtless out of print; but the point is that now is the time to apply for copies of the report of last year's Conference, in order that sufficient orders may be placed to justify the issue of an edition in English.

Broadcasting in the Kinema.—We recently had the pleasure of accepting an invitation to a private view at the New Gallery Kinema, Regent Street, of a film which has been produced for the General Electric Co., Ltd., by the Gaumont Film Co. for the purpose of stimulating public interest in radio-telephone broadcasting. The film, which is not too long, is of educational value and is presented in a form that can be readily understood and appreciated by all.

Electric Lighting for Taxi-cabs.—As a result of the Metropolitan police having given permission for the use of electric lighting on taxi-cabs, several concerns are now devoting attention to the production of dynamo sets specially designed for use on this type of vehicle. Among the latest to take up their manufacture are Messrs. C. A. Vandervell & Co. The dynamo is designed to give a constant output of 8 amps. at all vehicle speeds of 12 m.p.h. and over. We understand that an order for no fewer than 200 C.A.V. sets has been placed by Levey's Garage, a large metropolitan taxi-cab-owning concern.

West of Scotland Electricity District.—INQUIRY POSTPONED.—The Electricity Commissioners' inquiry, which was to have commenced at Glasgow on March 11th, has been postponed until April 23rd.

Ex-British Westinghouse Association.—The sixth annual reunion dinner will take place at the Holborn Restaurant on March 21st under the chairmanship of Sir Holberry Mensforth, K.C.B. Invitations have been issued, and if any member has not received one, will he kindly inform the hon. secretary, Mr. L. S. Richardson, 8, Hillside Road, Bushey, Herts.

A Dual-Frequency Paper Machine Drive.—Paper which is required to have an especially fine finish is put through a super-calendering process which is carried out by highly-skilled, experienced men. As a rule super-calenders are required to run at two speeds, the "threading-in" and "running speeds," the former being about one-tenth of the other. The usual way of arranging for this is the provision of two separate motors—a costly arrangement. To do away with this the Westinghouse Electric & Manufacturing Co. has introduced a system in which one motor performs both offices in a not-very-complicated manner. It consists of a motor which drives the lower calender roll through one chain or gear reduction, a control panel, a controller, stop push-buttons, safety switches, and a frequency-changer set with the necessary transformers. The frequency-changer set reduces the primary voltage and frequency to approximately 10 per cent. of their normal values. This causes the motor, which is of the wound-rotor type, and has a high starting torque at low frequency, to rotate at approximately 10 per cent. of its normal speed.

The Batti-Wallahs' Society.—The annual dinner of the Society is to be held at the Hotel Cecil on March 19th. The principal guest will be the Right Hon. Frank Hodges, M.P.

Institution Notes.

Institution of Electrical Engineers.—The following is the official list of fixtures for the remainder of the session :—

March 20th.—Sir Richard Paget, Bart. Lecture on "The Nature and Reproduction of Speech Sounds (Vowels)."
March 27th.—Lieut.-Col. H. E. O'Brien, D.S.O. "The Future of Main Line Electrification on British Railways."
April 10th.—S. C. Bartholomew. "Power Circuit Interference with Telegraphs and Telephones."
April 24th.—G. Semenza. The Fifteenth Kelvin Lecture. "Kelvin and the Economics of the Generation and Distribution of Electrical Energy."
May 8th.—Annual general meeting.

By-Law Alteration.—A special meeting of corporate members on February 28th unanimously passed a resolution, put by the President, and seconded by Sir J. Devonshire, enabling a new by-law to be substituted for by-law 9, entitling members and associate members to describe themselves as "chartered electrical engineers."

At the subsequent general meeting, a vote, proposed by Sir J. Devonshire, and seconded by Mr. R. T. Smith, congratulating Dr. A. Russell (the president) on attaining the "blue ribbon" of the scientific world, *i.e.*, Fellowship of the Royal Society, was passed with enthusiasm.

East Midland Sub-Centre.—On February 19th, at Loughborough, Mr. T. P. Wilmshurst, of Derby, took the chair, when Mr. H. V. Field, B.Sc., Wh.Sch., A.M.I.E.E., read a paper on "Recent Developments in Radio Communication." Mr. Field dealt with a variety of problems met with in transmission and reception, and spoke at length of the developments of high-power transmitting valves and valves with low-temperature filaments. The Magnetron type had been made up to a capacity of 1,000 kW, and held out possibilities of being the high-frequency generator of the future. The lecturer mentioned the difficulties of music and speech transmission, and described condenser and other microphones. The glow discharge type had great possibilities, since it recorded faithfully all frequencies, and would pick up vibrations too rapid or too faint for detection by the human ear. Trans-Atlantic radio telephony was greatly influenced by weather conditions, and wave lengths of 5,000 or over would probably have to be used. The lecturer considered that the success attending the 100-m. work between Pittsburgh and Manchester to be partly due to the fairly high aerial system used at the American station. With reference to the problem of lessening the effect of atmospherics, Mr. N. P. Hilton's invention, operating by virtue of rejector circuits designed for either radio or audio frequencies, had proved effective at stations in England, Egypt, and elsewhere. The choice of materials was of great importance in the manufacture of loud speakers. Corrugated diaphragms gave a more uniform response over the audio frequency range than the flat type. Horns of some "dead" material, such as wood or ebonite, gave better results than metal horns. Special loud speakers for addressing large public meetings had been used very successfully, and one rated at 2 kW had been developed.

Junior Institution of Engineers.—Electricity in the Modern Hospital.—In a recent lecture, at Sheffield, on the engineering equipment of a modern hospital, Mr. F. Seymour Sweet, M.R.San.I., suggested that electricity was not a commercial problem as regarded heating and cooking. The outlay on an up-to-date plant, properly managed and periodically inspected, was very soon paid for by economy in fuel, cost of maintenance, and by the increased general health of the staff and output of work.

Institution of Mining and Metallurgy.—Gold Medal Award.—The Institution has awarded Messrs. Herbert W. Gepp and Gilbert Rigg, conjointly, the gold medal of the Institution for their work on the treatment of complex sulphide ores, with special reference to their success in the establishment of the electrolytic process for the production of zinc in Australia. The award is the premier distinction within the gift of the Institution, and is awarded infrequently and only for important achievements. Mr. Gepp, who is general manager of the Electrolytic Zinc Co. of Australasia, is shortly visiting this country, whilst Mr. Rigg follows to join the National Smelting Co., the biggest zinc producer in the United Kingdom.—*The Times.*

Association of Mining Electrical Engineers.—The annual meeting and summer conference are to be held from June 11th to 14th. The headquarters will be at the St. Pancras Hotel. A great deal of the time will be spent at the British Empire Exhibition. Members wishing to participate in the meeting are asked to communicate with the honorary secretary of the London branch, Mr. J. L. Cowie, c/o Messrs. A. Reynolds and Co., Ltd., 57-59, Victoria Street, S.W.1. At a meeting of the South Wales Branch to-morrow (Saturday) Mr. W. Pearson is to read a paper upon "The Construction and Design of the Brush-Ljungström Turbine." The annual dinner of the branch is to be held on April 5th, at Cardiff.

Royal Institution.—At a general meeting on March 3rd the thanks of the members were returned to Major C. E. S. Phillips for his donation of £50 to the Research Fund, and to Mr. T. B. Gilley for a present of radioactive minerals from Cornwall.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.

At a meeting of the Croydon Town Council, on February 18th, the Finance Committee recommended that the salary of the Borough Electrical Engineer, Mr. A. C. Cramb, should be increased from £1,200 to £1,400 per annum. An amendment that the increase be not granted was rejected by 14 votes to 31, and eventually the matter was referred back to the Committee for reconsideration.

We read in the *Industrial Australian* that the degree of Doctor of Science of the Melbourne University has been conferred on Mr. H. Herman, engineer in charge of the State Electricity Commission's briquetting enterprise.

An official announcement was issued last week by the London, Midland and Scottish Railway Co. to the effect that Sir Guy Granet had been elected chairman of the company, vice Lord Lawrence of Kingsgate. Mr. Roger T. Smith, electrical engineer, has retired, and the electrical engineering department will now be merged in the chief mechanical engineer's department at Swindon, which will in future deal with all matters concerning electrification and electrical equipment. Mr. J. R. W. Grainge, the present assistant to the electrical engineer, has been appointed electrical assistant to the chief mechanical engineer.

Mr. J. Constantine, of Kenton, Newcastle-on-Tyne, has just retired from the service of the Newcastle Corporation tramways after a service of fifty years in connection with traction work. In 1878 he left Liverpool to join the undertaking of the Newcastle and Gosforth Tramway & Carriage Co., the tramway track being then two miles long. That concern was wound up in 1901, and Mr. Constantine then entered the service of the Corporation, and until his retirement was engaged as chief traffic clerk. Counting in the five years Mr. Constantine was with the Liverpool United Omnibus and Tramway Company, it makes exactly 50 years that he has been so engaged.

Mr. C. H. Barclay has resigned his position on the board of Oliver Pell Control, Ltd.

Mr. Robt. B. Maccall, the secretary and treasurer of the Glasgow Corporation Electricity Department, who, next month, will complete 50 years' continuous service with the Corporation, is to be entertained at a complimentary dinner, arranged by Mr. R. B. Mitchell, the chief electrical engineer, at which a presentation is to be made to mark the interesting event. Amongst those who have promised to be present are Sir Tom Callender, Mr. W. W. Lackie, one of the Electricity Commissioners, and Bailie Dewar, the convener of the Corporation Electricity Committee.

Mr. J. E. Stewart, M.Inst.C.E., M.I.E.E., of Llanelly, late engineer and manager of the Llanelly & District Electric Supply Co., has opened an office at 3, Gloucester Place, Swansea, as a consulting engineer.

Mr. C. L. Dalton, late Midland representative for Messrs. Credenda Conduits, Ltd., has joined the staff of the Cable Accessories Co., Ltd., as an additional representative for its "Revo" electrical specialities.

Mr. H. E. Blain, assistant managing director of the London Underground Railways and the L.G.O.C., has been appointed Principal Agent to the Unionist Party organisation in place of Vice-Admiral Sir Reginald Hall, who recently resigned.

Obituary.—Mr. Stanton Swire.—The death occurred, on February 19th, at Radlett (Herts.), of Mr. Stanton Swire, who was for a long period associated with Callender's Cable and Construction Co., Ltd., for whom he travelled extensively.

Mr. A. Williamson.—The sudden death is announced of Mr. Arthur Williamson, a retired electrical engineer, of Victoria Road, Buckhurst Hill, Essex.

Mr. J. B. Glenn.—We regret to learn of the death, which occurred on February 29th, at his residence at Tufnell Park, London, of Mr. Joseph Barber Glenn, of Moorgate Station Chambers, E.C.2. Mr. Glenn was 84 years of age. *The Times* "Deaths" column states that he was "for over 51 years connected with tramway and electrical industries." He was very prominently associated with electric tramway companies. At the time of his death he was managing director and secretary of the Provincial Tramways Co.; director and secretary of the Isle of Thanet Electric Tramways and Lighting Co., Ltd.; and a director of electric lighting or traction companies operating at Gosport, Great Grimsby, Portsdown, Plymouth and Devonport.

New Companies Registered.

Marconiphone Co., Ltd.—The company now known as the Marconiphone Co., Ltd., is not a newly-incorporated concern, but is the company which was registered on May 28th, 1915, as the "Poulsen Wireless Telegraph Co., Ltd." It changed its name as above, with the consent of the Board of Trade, on December 29th, 1923. In the present month three of the former directors (Messrs. S. F. St. J. Steadman, M. A. Bramston, and J. St. V. Pletts) resigned, and shortly before that Messrs. V. Gandil and C. Hage had resigned. Some new appointments have been made, and the board now consists of:—F. R. Wade, Dr. Johnson's Buildings, E.C.4, consulting engineer; A. F. H. S. Simpson, 59, Cadogan Square, S.W.1 (deputy managing director, Marconi's Wireless Telegraph Co., Ltd.); H. Morgan, 3, The Park, Highgate, N.6, accountant; E. B. C. Woodbury, 16, Prince of Wales Terrace, W.8, company director; E. Cameron, "Lyne Grove, Virginia Water (director of Sterling Telephone and Electric Co., Ltd.). Secretary: A. Ogle. Registered office: Marconi House, W.C.2. The authorised capital is £450,000 in shares of £1 each, all of which have been issued. To December 31st, 1922, £56,254 7s. 6d. had been paid up in cash, being £1 per share on 7 and 7s. 6d. per share on 149,993 shares, and 300,000 shares were credited as fully paid. Mortgages and charges, nil. Certain clauses in the original articles of association, which related to the nomination of directors (under certain circumstances) by Christopher Hage and the company known as Det Kontinentale Syndikat for Poulsen Radio-Telegrafi Aktieselskab, have been deleted by special resolution.

Fluid Propulsion (195,869).—Fluid Propulsion, Ltd., was registered on February 20th as a private company with a nominal capital of £1,000 in 100 founders' shares of 1s. each and 995 7 per cent. cumulative preference shares of £1 each. The objects are: To acquire patent 24,001 of 1910, granted to Nikola Tesla, for an improved method of imparting energy to or deriving energy from a fluid, and apparatus for use therein, and all present and future inventions by him, with respect to fluid propulsion in Great Britain and Ireland, the Isle of Man, and all British Colonies, except Canada; to acquire various patents granted to the vendor (1) for improvements in methods of, and apparatus for, the generation of power by elastic fluid turbines; (2) for an improved process of, and apparatus for production of high vacua; (3) for method of, and apparatus for aerial transportation; (4) for improvements in the construction of steam and gas turbines; (5) for improved method of, and apparatus for the economic transformation of the energy of steam turbines; and (6) for improved process of, and apparatus for deriving motive power from steam; to adopt an agreement with the said vendor and J. R. Hatmaker, and to carry on the business of manufacturers of turbines, motors, engines, pumps, vacuum pumps, compressors, refrigerating apparatus, helicopters, flying machines, automobiles, boats, ships, locomotives, and machinery, &c. The first directors are: N. Tesla, 8, West Fortieth Street, New York City, consulting, electrical, and mechanical engineer (president, Tesla Co., Inc., New York); J. R. Hatmaker, 72, Avenue d'Iéna, Paris (director of Ambrosia, Ltd., London, and president of Mammala Corporation and Ambrosia Milk Corporation, both of New York); F. M. T. Lange, 35, Gloucester Gardens, Bayswater, W.2, engineer. The founders' shares confer the absolute control of the management. Holders of founders' shares Nos. 2-46 may appoint one director, and holders of founders' shares 47-91 have a similar right. N. Tesla and J. R. Hatmaker are deemed to be the first nominees. The founders' shares take (a) all the profits after payment of the preferential dividend, and (b) in any winding-up, all surplus assets after repayment of capital on the preference shares. The founders' shares, other than those subscribed for by F. Lange and those to be issued to N. Tesla and J. R. Hatmaker under the above-mentioned agreement, are to be issued only for cash, on such terms as may be fixed by the directors, but none of them shall be issued to either N. Tesla or to J. R. Hatmaker. The registered office is 164, Buckingham Palace Mansions, S.W.

Listenola, Ltd. (195,978).—Private company. Registered February 25th. Capital, £100 in £1 shares. To carry on the business of engineers, advisers, experts, consultants, contractors, and the like in connection with wireless telephony and telegraphy, &c. The first directors are:—R. W. Tarr, "Hazeldene," Newton Road, Mumbles, near Swansea, cabinet manufacturer; Mrs. R. Tarr, "Hazeldene," Newton Road, Mumbles, near Swansea. Qualification, £40. Remuneration as fixed by the company. Secretary: R. W. Tarr. Solicitor: R. A. Jones, 21, York Street, Swansea.

Brundall and District Service Co., Ltd. (195,956).—Registered February 25th. Capital, £4,000 in £1 shares. To adopt an agreement with the Corporation of Norwich for the supply of electricity in bulk by the Corporation to the company for the period referred to in an agreement dated May 11th, 1923, between the Corporation, F. H. Cooper, and W. L. Clabburn, and to carry on the business of dealers in, and suppliers of electricity, &c. The subscribers are:—A. H. Beever, Great Yarmouth, baker, 1 share; P. G. Back, Brundall, wine and spirit merchant, 1 share; N. Howlett, Eastwood, Old Catton, pianoforte manufacturer, 1 share; F. H. Cooper, Brundall, kinema proprietor, 1 share; F. S. D. Page, Bradestone House, Brundall, managing director of Page Bros. (Norwich), Ltd., 1 share; N. S. Carruthers, Brundall, physician and surgeon, 10 shares; A. Bacon, 47, Distillery Street, Norwich, managing clerk, 1 share. Minimum cash subscription, £250. No persons had consented to act as directors to February 23rd. Qualification, £250. Remuneration as fixed by the company. Registered office: 5, Alexandra Mansions, Prince of Wales Road, Norwich.

Official Returns of Electrical Companies.

British Columbia Electric Railway Co., Ltd.—Issue on February 18th, 1924, of £1,100,000 debentures, part of a series already registered.

Nefa Co., Ltd.—Debenture dated February 18th, 1924, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: S. Culverwell, 16, Carisbrook Road, Westcliff-on-Sea.

Farndons Electric, Ltd.—P. H. Stone, of 47, Temple Row, Birmingham, was appointed receiver on February 11th, 1924, under powers contained in debenture dated May 17th, 1923.

Sanders, Kennedy & Co., Ltd.—F. J. Sully, of Bank Chambers, Bridgwater, ceased to act as receiver or manager on February 6th, 1924.

Boulton Manufacturing Co., Ltd.—C. D. Buckle, of 25, Cheapside, Bradford, was appointed receiver on February 11th, 1924, under powers contained in debenture dated September 20th, 1923.

Consolidated Signal Co., Ltd. (71,141).—Return dated January 11th, 1924. Capital, £425,000 in 220,000 preference and 205,000 ordinary shares of £1 each. 214,195 preference and 150,548 ordinary shares taken up. £52,839 paid on 24,999 preference and 27,840 ordinary shares. £311,904 considered as paid on 189,196 preference and 122,708 ordinary shares. Mortgages and charges, nil.

Park Electrical and Engineering Co., Ltd.—F. W. Palmer, of 74, Wellington Road, Oldham, was appointed receiver on February 16th, 1924, under powers contained in debenture dated August 22nd, 1922.

Carlisle, Wiles & Co., Ltd.—Mortgage dated February 23rd, 1924, to secure £540 and further advances, charged on 629, Penistone Road, Sheffield. Holders: Halifax Permanent Benefit Building Society.

Foot's Cray Electricity Supply Co., Ltd. (86,863).—Return dated April 19th, 1923 (filed January 28th, 1924). Capital, £20,000 in £1 shares. 10,000 shares taken up. £10,000 paid. Mortgages and charges, £3,800.

City Notes.

W. T. Henley's Telegraph Works Co., Ltd.

The annual meeting was held on February 29th, Sir George Sutton, Bt., in the chair. In proposing the adoption of the report (*vide* our last issue, p. 346), the Chairman, after a fitting allusion to the loss the Company had sustained since the last meeting by the death of Mr. Sydney Gedge, said that with regard to the balance sheet, on the debit side there was no change which called for comment. Turning to the credit side they would observe that there was an addition of £91,425 to buildings, machinery and plant. The expenditure was principally due to the transference from Woolwich to Gravesend of the manufacture of telephone cables. They had outgrown the space available at Woolwich and had provided at Gravesend a new building and additional machinery for increased output. The space made available at Woolwich by the removal was being equipped with machinery for the extension of the other operations carried on in those works. A large sum had been spent at Gravesend in the building and equipment of a new research department. With the progress of the business they must expect to add to the capital value of their assets. In the current year they might have to expend a large sum for a new warehouse and offices in London. Their lease of Blomfield Street, held from the City Corporation, expired early in 1925. The Corporation would not negotiate for an extension, and if they had to purchase premises, the cost might be anything between £50,000 and £100,000. There was an increase in the stock over last year of, roundly, £100,000. That arose from increased trade, and comprised not only raw material but also expenditure on orders in hand, which was greater than a year ago. Again this year they were not asking the shareholders to vote anything for the pension fund. The rise in the value of trustee securities which were held by the fund made it unnecessary. The pension fund amounted to, roundly, £142,000 and provided liberally for old age, sickness, and death. They enclosed with the report a circular respecting the corporation profits tax. The whole burden of taxation bore heavily on the results of their business; the cost to them was just under £100,000; this was an important item in the cost of their products. He thought they might congratulate themselves upon the successful results of the year's work, not much better as regarded profit than the previous year, but in other respects much more satisfactory. Comparing with past years the prices of the commodities they employed in the business, and the rates of profit, they found that the output of their factories for the year was the largest in the company's career, ranging in the various departments from 15 per cent. to 50 per cent. more than in the previous year. That meant that employment and wages had considerably increased and that the rate of profit had decreased, or, to put it in another way, an increased demand had enabled them to lower their prices to their customers, to employ more people, and to maintain the same distribution to the shareholders. But perhaps the happiest feature of the year was that that increased employment, that augmented number of people employed, was partly due to an increased output per head of the workers in their cable factories. Their factories had been busy, and their experience was that a factory well stocked with orders yielded a better output per head of the workers than a factory with a shortage

of orders. He would not have them, however, suppose that the demands upon their factories had been entirely satisfactory. The foreign trade which was an important part of their turnover before the war had not been recovered; it now represented but a small percentage of their total. It was no use shutting their eyes and supposing that all was well all round because they had such a good balance sheet. That balance sheet represented the prosperity of their home and Imperial trade. In foreign countries many new works had been erected, and tariff walls erected; countries which were importers of their goods before the war were now ambitious to themselves manufacture. That applied even to some of the oversea Dominions. No doubt they possessed great advantages, in experience, skill, and organisation, and if tariffs against them were not outrageously high, if their competitors' goods were not offered for sale with the advantages of greatly depreciated exchanges, and if they could utilise their home markets to keep plenty of work in their factories and so keep down the cost of production, he did not despair of regaining at any rate a large part of the lost foreign trade. There was a paragraph in the report concerning the Henley's Tyre and Rubber Company, Ltd. He would not take up their time by saying again what he said on the last occasion upon which he addressed them. The position was the same, or a little worse. They had the goods, but the selling prices were much too low to enable them to trade at a profit. It was not pleasant to learn that men discharged for want of orders were engaged in unloading tires from ships from America. The country had decided, at any rate for the time being, not to give tariff protection from dumping by foreign countries. The decision was unfortunate for their pneumatic tire industry, the outlook was not promising, and they were now seeking other means to enable the factory to meet its expenses. Proceeding, he said that their large profits might expose them to the charge of "profiteering." The company had had an uninterrupted successful career for five and thirty years. Could anyone suppose that that could have happened if they were accustomed to overcharge on the articles they manufactured? But they continued to pay a 15 per cent. dividend; how was it done? For thirty-five years of annual profit, they had set aside a very considerable part for the purpose of providing extensions to increase their output. Year in and year out the figure had grown. Most of it was in land, buildings, machinery and plant, and some of it was in more liquid assets, such as cash, stock, debtors, etc. The Company was started with assets and liabilities on an equality in values. Three years ago they published an account showing a surplus of assets over liabilities amounting to about a million-and-a-quarter sterling. They had no interest to pay on a large portion of that sum, the shareholders could have divided amongst themselves those surplus profits instead of leaving them to fructify in the business, and if they would trouble to make a calculation they would find that the 15 per cent. they were paying panned out at about 6 per cent. on the capital shown by the balance sheet to be employed in the business. As to the outlook for the future, it was unwise to be too optimistic, but they had more orders on their books than they had a year ago, and that showed trade improvement. Their relationship with their workpeople continued to be satisfactory, but, of course, disputes in other industries were detrimental to them both by reason of loss of output, and increased cost of production. Mr. Martin Roberts seconded the motion, which was carried unanimously after a short congratulatory discussion. Following the transaction of the usual business, a resolution moved by Mr. Crichton and seconded by Mr. Mackail, voting a bonus of £250 to each of the directors, was carried with enthusiasm. In thanking the meeting for the vote, the Chairman intimated that it was the intention of the board to make the accounts up to the 31st of March in each year instead of up to 31st December. Therefore the next annual meeting would not be held until May, 1925, when there would be a year and a quarter's dividend declared, less the interim distribution, which it was hoped to make as usual.

St. James' and Pall Mall Electric Light Co., Ltd.

The annual meeting was held on February 26th under the chairmanship of Mr. Walter Leaf. In the course of his speech Mr. Leaf said that, despite his prophecy to the contrary, 1923 had been a very prosperous year. Although, owing to the reductions in charges the revenue had fallen, the increased demand had almost made up for this. The company had entirely given up the production of energy; the whole of its supplies were obtained from the Central Company. This company sold 8,500,000 kWh more than in the previous year, and its revenue increased by £23,000, of which £17,000 was due to the Chelsea supply. Contrary to expectation, the cost of coal had been lower, and this partly accounted for the improvement in the generating costs from 1.191d. to 1.109d. per kWh. A great saving in coal consumption would be brought about by the new 15,000-kW set and the two new boilers. The conversion of the 8 per cent. notes to 5½ per cent. notes had been carried out, and a balance of £300,000 had been issued. The company was in a position to meet the demands of the coming year. Further requirements could only be dealt with when the new scheme for the electricity supply of London as a whole was settled. In that scheme the Central Co. would play a most important part. They had arranged to link up their mains with those of the Metropolitan, Kensington, and Notting Hill companies. This would enable spare plant to be pooled. To meet next winter's demand another 15,000-kW set was being installed, as well as two new boilers. Land had been purchased, and cooling towers would be erected during the year. They aimed at further extensions which would raise the ultimate capacity of the station to about 95,000 kW. Turning to the affairs of the St. James' Co., the chairman said that Carnaby Street had been changed over completely from a steam-driven generating to a motor-converting station. New accumulators had been installed and new offices for administration had been erected. During the present year the reconstruction of the Mason's Yard station would be proceeded with. The task of changing over from 110-220 to 220-440 V was progressing, and supply at the higher voltage was commenced in certain districts in September last. These changes would entail the expenditure of £144,000 during the next five years, that was the reason for the large contribution (£25,000) to the contingency fund.

Referring to the reorganisation of electricity supply in London, Mr. Leaf said that the London County Council had undertaken to extend the company's tenure for 40 years from 1931 on condition that the whole of the undertaking was handed over without payment at the end of the period, and that prices were charged according to a sliding scale. The whole future of the company depended on this agreement, and if it was approved far-reaching proposals with regard to future capital and revenue arrangements would be made.

The terms of the London Electricity Supply (No. 2) Bill, which will give effect to this arrangement, were approved at a subsequent extraordinary meeting.

Westminster Electric Supply Corporation, Ltd.

The annual meeting of the company was held on February 27th, Capt. Edmund I. Bax (chairman) presiding. In presenting the report and accounts (which were reviewed in our issue of February 22nd, p. 308), the chairman said that because of the reductions which had taken place in charges, the revenue had only increased slightly, although the sales of energy had increased by 3,750,000 kWh. Nothing had been added to the depreciation fund, as the amount standing to its credit (£331,800) was considered to be adequate. Instead, the contribution to reserve had been increased. Capt. Bax summarised the history of the Central Co., and said that it was through the rapid growth of the company, both in capacity and economy, that the Westminster Co. had been able to make the great reductions in its charges. The coal cost per kWh of the Central Co. had only increased by 0.026d. to 0.268d. since 1914, although the price of coal had risen by 57 per cent. The board considered that until the question of tenure had been settled, the institution of a staff pension fund was premature; it had been decided, however, to pay a bonus to the staff. The reductions which had been and were being made would reduce the cost to the majority of the lighting consumers to the pre-war level, although the cost of labour and materials was still from 70 to 100 per cent. above pre-war rates. The chairman claimed that the average charge made by the companies for electricity for industrial purposes was lower than that of municipalities, although the overall average was higher. During 1923 670 new consumers were added to the company's mains, making the total number 15,142, and industrial connections predominated. Speaking of the current year, Capt. Bax said that the output continued to expand, and the sales during the first eight weeks of the year were 1¼ million kWh in excess of the output in the equivalent period of 1923. There was still a large part of the area comparatively undeveloped, and they looked forward to a more rapid increase in demand.

After the adoption of the report, an extraordinary meeting was held for the purpose of approving the terms of the London Electricity Supply (No. 2) Bill. The chairman explained the measure, and said that it was hoped that the question of the sliding scale of charges would soon be settled with the London County Council.

The resolution was carried.

Clyde Valley Electrical Power Co.

The annual meeting was held on February 26th in Glasgow, Sir F. C. Gardiner, K.B.E., presiding. The chairman, after reviewing the progress of the company since its inception in 1905, said that new connections amounting to 21,684 h.p. had been made to the system during 1923, and over 150,000,000 kWh had been supplied. The average rate received was just over 1d. per kWh—a very reasonable charge. A system had been instituted whereby consumers who operated plant with a good power factor received substantial reductions amounting sometimes to 14 or 15 per cent. Referring to the application of the Glasgow Corporation for powers to supply electricity in part of the company's area (which was refused by the Electricity Commissioners), the chairman said that he regretted this action when every endeavour was made by the company to co-operate with other producers. Arrangements had been made to give a large supply to Paisley, and simultaneously the company had arranged to take this from the Ayrshire Joint Board and the Greenock Corporation. In mentioning the reorganisation of electricity supply in the West of Scotland, the chairman said that he thought the area was being efficiently served by the present undertakers; the shutting-down of the smaller stations would follow in any event. With regard to the future, he said the prospects were good.

The company had an area of about 735 square miles, including one of the greatest industrial districts in the United Kingdom, and it would be difficult to put a limit on the extent to which, in course of time, it might use electric power. The new contracts were substantially higher than last year. Application had been made to Parliament for additional powers, including the splitting of the shares into others of £1 denomination, and the raising of additional capital.

The report and accounts were adopted, and a resolution passed increasing the directors' remuneration.

Underground Electric Railways Co. of London, Ltd.

The report for 1923, submitted at yesterday's meeting, shows that the total receipts were £846,198, a decrease of £41,427. Expenditure decreased by only £13,031 to £111,534, making the net receipts £734,664 as against £763,060 in 1922. Interest on the 4½ per cent. bonds (plus income tax), the 6 per cent. 3-year secured notes, and the 6 per cent. first cumulative income debenture stock absorbed £193,919, and £48,979 was added from last account, rendering available £589,724. The interest on the 6 per cent. income bonds required £494,085, and a balance of £95,639 is carried forward. The reduced income from investments is stated to be due to the sale of certain stocks of the London Electric Railway Co. and the City & South London Railway Co., out of the proceeds of which the 6 per cent. 3-year secured notes have been paid off. There was a saving in the interest on these notes for part of the year. The loss on exchange due to the payment of interest in dollars and Dutch florins is put at £40,644; this is included in the year's expenditure. The book value of the company's investments is shown at £14,269,890, a reduction of £786,970 due to the sale of the above-mentioned stocks. The loan from bankers at £600,000 is £310,000 less than a year ago. All advances made to the Associated Equipment Co. have now been repaid. The operations of this company during 1923 showed a profit of £46,790, so that after deducting the debit balance of £42,057 which remained at the end of 1922 there is a credit balance of £4,733 to carry forward. The Common Fund of the "Underground" group decreased from £1,029,795 in 1922 to £1,001,982 in 1923. The decline in traffic experienced by the London and Suburban Tramway Company's undertakings caused the dividend on the preference shares to be reduced by a half. The report reviews the activities of the companies in which it is interested; these were dealt with in our abstracts of the individual companies' reports.

Llanelly and District Electric Lighting and Traction Co., Ltd.

The company's profit rose from £33,325 in 1922 to £35,479 last year. £5,000 is transferred to general reserve, and £1,000 to contingency reserve. It is proposed to pay a final dividend of 4 per cent., making 7 per cent. for the year, as in 1922, and to carry forward £1,071. The directors are seeking powers to issue further 5 per cent. debenture stock to permit of the early redemption of the 7½ per cent. stock. It is proposed to alter the name of the company to "The Llanelly and District Electric Supply Co."

The annual meeting was held on February 29th. Mr. A. R. Holland (chairman), who presided, said that the output had increased by 1,156,380 kW to 13,760,785 kWh. The new 5,000-kW set had been in regular service during the past few months and was reducing production costs. Formal consent had been received to the extension of the company's area of supply in Llangennech and Llanelly. The report was adopted and at subsequent extraordinary meetings approval was given to the shortening of the company's title, and to a resolution proposing the creation and issue of first mortgage debenture stock.

North Metropolitan Electric Power Supply Co.

Sir James Devonshire, K.B.E. (chairman), presided at the annual meeting on February 26th, and in presenting the report and accounts (*vide* Elec. Rev., February 22nd, p. 306), said that the company was now operating 19 separate undertakings, and these varied in many ways, making it difficult to adjust rates. Reductions of charges had been made in connection with the majority of the undertakings, and they had endeavoured to arrange that the rates of supply in undertakings corresponding to one another should be the same. The sales of energy showed an increase of over 13 million kWh; about 42 per cent. of this increase was due to increases in bulk supplies to local authorities and companies. There had been an expansion of business in every direction. There was a notable tendency for domestic consumers to use electricity for many other purposes than lighting. The "annual service rate" instituted by the company enabled many domestic consumers to obtain electricity at the low inclusive average rate of 1¼d. per kWh.

Charing Cross Electricity Supply Co., Ltd.

West End Undertakings.—The gross earnings during 1923 were £320,334, a decrease of £12,822, and the expenses, including depreciation, decreased by £14,825 to £172,182. Adding to the balance £18,014 brought forward and interest and dividends amounting to £49,903, there was an available total of £216,069. From this have been deducted:—Interest on debenture stock, £17,829; depreciation, £22,000; dividend on the preference shares for the year, £18,000; and an interim dividend at the rate of 5s. per share on the 80,000 £5 ordinary shares, £20,000; leaving £138,239 to be dealt with. It was proposed at the meeting on March 4th to pay a final dividend at the rate of 9s. 6d. per share on the 96,000 £5 ordinary shares for the latter half-year, £45,600; to transfer £73,000 to general reserve (income) account; and to carry forward the balance of £19,639. It was further recommended that of the amount of £148,000 standing to the credit of the general reserve (income) account, £96,000 be capitalised and applied in paying up 96,000 of the converted unissued ordinary shares of £1 each, and that such shares be allotted, fully paid, to the holders of the ordinary shares of the company in the proportion of one such share for every five of the converted ordinary shares of £1 each held on March 1st, 1924. The connections now total 27,308 kW.

City Undertaking.—The gross earnings fell from £437,992 to £409,533, and the expenses from £247,920 to £205,403. Adding a balance of £10,918 brought forward, there is a total available of £215,048. After providing for interest on debenture stock, 6½ per cent. 5-year secured notes, loans and advances, £60,713; dividend on preference shares, £18,000; and an interim dividend at the rate of 10s. per share on the ordinary shares, £35,000, there remains £101,335 to be dealt with. The directors proposed to transfer £85,000 to the general reserve (income) account, and to carry forward the balance of £16,335. The connections now total 33,237 kW.

Liverpool Overhead Railway Co.

The annual meeting was held on February 28th, at Liverpool, Mr. G. D. Killey presiding. The Chairman, in moving the adoption of the report (Elec. Rev., Feb. 22nd, p. 206), said that the competition resulting from the action of the Liverpool Corporation in extending its penny tram stages in October last had, no doubt, somewhat interfered with the company's traffic, as also had other circumstances. Dealing with the future, he said that if trade improved, the railway should materially benefit, as they depended practically on the trade of the port. The dock strike had seriously prejudiced their income, but if a trade improvement set in within the next ten months he hoped this would be more than compensated for.

Mr. M. H. Maxwell seconded the adoption of the report.

Mr. Keet (an ordinary shareholder) said that the company had received between £30,000 and £40,000 in compensation from the Government, and he asked if it was not possible to use part of that money for the benefit of the unfortunate ordinary shareholders.

Mr. J. P. McKenna asked whether the directors were quite satisfied that they had done the right thing in reducing the expenditure on the maintenance of the permanent way and rolling stock.

The Chairman said while he fully sympathised with the ordinary shareholders, there were reasons why the compensation money should be conserved for the present.

The report was adopted.

Mather & Platt, Ltd.

After the deduction of directors' fees and depreciation, and making provision for doubtful debts, the net profit for 1923 was £325,200; £47,302 was transferred to income tax equalisation account, and £174,953 was brought forward, making available £452,942. Interim dividends for the first half-year absorbed £78,183, and it was recommended that a dividend of 5 per cent., making 10 per cent. for the year (tax free) be paid on the ordinary shares, together with a bonus of 5 per cent. (tax free); that £50,000 be transferred to reserve; and £178,393 carried forward.

In the course of his speech at the annual meeting on February 28th, Mr. John Platt said that the firm's position had improved in spite of the moderate volume of business brought over from the previous year. The electrical department had secured orders for more machines during 1923 than in any previous year. Their most recent departure, the construction of rotary converters, was making good headway.

Vickers, Ltd.

A general meeting of the holders of the 4 per cent. first mortgage debenture stock is to be held on March 14th to consider proposals for the creation of £6,000,000 5 per cent. debenture stock. The issue of the new stock is for the purpose of retiring the existing 4 per cent. debenture stock (£1,125,000) and the 7 per cent. seven-year notes (£1,500,000) and to provide fresh working capital. The initial issue will amount to £3,250,000. The stock will be charged upon the company's works in various places.

Clarke, Chapman & Co., Ltd.—A final dividend of 2½ per cent. on the ordinary shares is recommended, making 5 per cent. for the year. £3,428 is carried forward after allocating £15,221 to depreciation.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

North Wales Power Co.—323,000 ordinary shares of £1 each, fully paid, Nos. 1 to 323,000.

Traction and Power Securities Co.—£427,050 5 per cent. cumulative preference stock, and £256,230 ordinary stock.

British Columbia Electric Railway Co.—£770,000 5 per cent. (income tax free) 1944 debenture stock, issued at 95 per cent., partly paid and fully paid

Cammell, Laird & Co.—1,182 ordinary shares of £1 each, fully paid, Nos 3,232,879 to 3,234,060.

Charing Cross Electricity Supply Co.—480,000 ordinary shares of £1 each, fully paid, Nos. 1 to 480,000; 400,000 4½ per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 400,000; 400,000 City undertaking 4½ per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 400,000.

Greengate & Irwell Rubber Co., Ltd.—According to the *Financial Times*, a further advance in profits is shown by the report of this company for the year 1923, the trading profit, after providing for all expenses, amounting to £90,905, compared with £75,048 for 1922 and a loss of £61,514 for 1921, which was met by a refund of excess profits duty. The balance available, including £11,896 brought in, is £102,801, an improvement of £25,593. After reserving for corporation tax £3,375 and for income-tax £4,500, the directors propose a final dividend on the ordinary shares of 1s. 3d. per share, making 2s. per share, against 1s. 3d. per share for 1922, again placing £10,000 to reserve, leaving to be carried forward the increased balance of £19,301.

Pinchin, Johnson & Co., Ltd.—The net trading profit for 1923, after providing for all expenses, depreciation of leasehold properties, plant, machinery, &c., and income tax and corporation profits tax, amounted to £103,545 (against £70,549). The directors propose to pay a final dividend on the ordinary shares of 16¼ per cent. actual, making a total of 22½ per cent. for the year (against 15 per cent.); to write off the whole balance of preliminary expenses, £10,416 (against £6,000); to carry to reserve the sum of £10,000 (against £7,000), and to carry forward £23,159 (against £16,905). Meeting: March 12th.

Scottish Power Co., Ltd.—The trading profits of the undertakings owned and operated by the company amounted to £46,973. Of this amount £7,500 was appropriated by the undertakings for reserves. After the payment of expenses there was a balance of £39,905 (including £2,498 brought forward). It was proposed to transfer £8,500 to reserve, to pay a dividend of 8 per cent. (less tax) on the ordinary shares, and to carry forward the balance £2,428).

Neuhausen Aluminium.—The directors of the Aluminium Industrie A. G. of Neuhausen report net profits of 8,038,000 fr. for 1923 as compared with 4,242,000 fr. in the previous year. It is proposed to pay a dividend at the rate of 12 per cent. as against 9 per cent. in 1922. The sum of 2,000,000 fr. has been transferred to the reserve fund, 250,000 fr. allocated to the pension and welfare fund, and 229,000 fr. is carried forward.

Crowborough District Gas and Electricity Co., Ltd.—The report for the first nine months' working of the electricity department showed a revenue of £878 and a loss of £163, but it was explained at the general meeting that this was due to incorrect book-keeping; certain charges should have been made against the gas section.

Mackay Companies.—The income from operating companies for 1923 amounted to $4,898,565, while operating expenses totalled $292,489, leaving $4,606,075 to be carried to surplus account, making it $6,719,504. After deducting dividends amounting to $4,596,502, the surplus account stands at $2,123,001.

Belgian Companies.—The *Omnium de Constructions Electriques et d'Appareillage* has increased its capital to 4,000,000 fr.

The *Société Anonyme Electro-Lux* has raised its capital from 100,000 fr. to 1,000,000 fr.

Capital Reduction.—TUCUMAN TRAMWAYS, LIGHT & POWER CO., LTD., AND REDUCED.—A petition for the confirmation of the reduction of capital of this company from £611,000 to £561,000 has been presented to the High Court Chancery Division, and will be heard in London on March 11th.

Uxbridge and District Electric Supply Co., Ltd.—It is proposed to pay a dividend of 8 per cent. on the ordinary shares, to transfer £14,000 to the depreciation fund, and to carry a balance of £975 forward.

Midland Counties Electric Supply Co., Ltd.—The annual meeting was held on Monday last. Pressure on our space compels us to hold over the report of the proceedings until our next issue.

Canadian General Electric Co., Ltd.—Dividends of ¾ per cent. on the ordinary stock and ¼ per cent. on the preference stock have been declared for the half-quarter ending March 31st.

Waste Heat & Gas Electrical Generating Stations, Ltd.—Final dividend of 6½ per cent., making 8 per cent. for the year, less tax.

Brazilian Traction, Light & Power Co.—Quarterly dividend on cumulative preference shares of 1½ per cent. Payable April 1st.

Globe Telegraph & Trust Co., Ltd.—Quarterly dividend of 5s. per share net on the ordinary shares, payable March 28th.

Mirrlees Watson Co., Ltd.—Dividend of 10 per cent., less tax, for 1923, as in the previous year.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets in most departments show a very firm front, and money continues to flow steadily into investment stocks and shares of all descriptions. This, in the face of the fact that trade is beginning to look up in various branches, is accepted as an evidence of there being plenty of surplus capital over and above what is likely to be wanted for industry in the near future. It is at this season of the year that apprehension usually begins to talk about the possibility of money rates being stiffer, but, up to the present at any rate, no hint of this is disturbing the markets.

There was an extraordinary rush for the £770,000 5 per cent. tax-free debenture stock issued by the British Columbia Electric Railway Company at 95. The subscription lists closed within an hour or two of their having been opened, but shareholders had the right to apply for two more days. Of course these shareholders observed the alacrity with which the public rushed for the stock, and in consequence, over-applied heavily for the stock, with the result that outsiders had their cheques returned and the allotments to the shareholders proved to be very small—about 13 per cent. of their applications. Protests have arisen against the way in which the issue was made, but the action of the board can be defended on the ground that the directors could scarcely have anticipated such a demand for the stock, though it stands to reason that such an advertisement as it received through the immediate closing of the public subscription lists was bound to encourage the proprietors to send in their preferential forms. The price is about 6 premium, and the stock is a thoroughly sound investment.

Electricity supply shares have lost a good deal of the elasticity which distinguished them earlier in the year, for which the reason is that the excellent dividends were discounted in advance, and, upon the appearance of the announcements, some of the earlier buyers elected to take their profits in view of the uncertainty felt with reference to the passage of the Electricity Bills through Parliament. The fact of there being a Labour Government in power is one of the elements taken into account. Those who are in close touch with the business are of opinion that the Bills will be duly passed, and that the companies will secure their extra forty years' tenure of life. But, in the meantime, the prospective purchaser, looking at the fairly high prices which prevail, is inclined to adopt an Asquithian attitude.

It may also be added, without breach of confidence, that a good many thousand shares have come into the market on behalf of deceased estates, one of the largest of which will be easily surmised by those who know in what direction blocks of electricity supply shares have been absorbed for some years past. It says a good deal for the strength of the market that lines of five and ten thousand shares at a time can be placed to-day without disturbing the equilibrium of the market, or causing more than a fractional change in the current quotations.

Bromptons are 3s. 6d. down, County ordinary 2s. 6d., South Londons 2s. 9d. Charing Cross ordinary are now being negotiated indifferently as £5 shares and in their split state of £1 shares. The former are priced at 14¼, and the new at about 56s. Edmundsons are better at 3¼. Bournemouth and Poole at 47s. 6d. show a gain of 3/16. Newcastle-on-Tyne ordinary, the dividend on which has gone up from 2½ per cent. to 6 per cent., rose 1s. 9d. to 18s. 9d. Lancashire Electric Supply preference improved to 25s. 6d. Llanelly ordinary at 20s. 6d. and the preference at 19s. continue to be dealt in freely. Midland Electric Power Corporation ordinary have strengthened to 25s. 6d.

It will be noticed that our price-tables give the electricity supply dividends—and those of the electric railways—for 1923 as well as for 1922. At present, the change cannot be extended to the other groups, because the majority of the companies have not yet announced their results for last year.

Marconis gave way abruptly from 41s. 3d. to 35s. upon the publication of the Wireless Committee's report. A rally to 36s. 3d. still leaves the price 3/16 down on the week, and the preference are correspondingly lower at 32s. 6d. The Report disappointed many hopes, and it is asked, rather indignantly, whether the recommendations are likely to agree with the love of fair play that characterises public opinion.

Cable stocks and shares show a tendency to droop; the declines are mostly negligible. Western Telegraph ordinary and Globe preference have gone back. Anglo-American deferred is 5s. down. Great Northerns shed 10s., United River Plate Telephone new went back to 78s. 9d. for the shares £2 10s. paid. Henley's remain at 2 7/16. The chairman's speech (well worth reading) at last week's meeting showed that the home markets for the company's manufactures are mostly in a satisfactory enough condition. Siemens have lost a few pence at 16s. 9d. British Insulated returned to 50s., and Babcocks to 47s. Vickers propose an interesting scheme for re-arrangement of the company's prior-charge obligations. The shares advanced at first, but, later on, gave way to 12s. 9d. Rubber shares were not materially affected by a further reaction, to 1s. 1¼d. per lb., in the price of the product.

British Columbia Electric Railway stocks have not yet recovered from the issue of the new and cheap debenture stock. The 5 per cent. preferred is 4 points lower at 83¼, after being down to 82. As the yield is barely 6 per cent., less tax, and the new 5 per cent. tax-free debenture was offered at 95, the fall in the former calls for no explanation. Brazilian Tractions continue to mount and Anglo-Argentine Tramways 5 per cent. debenture is better at 75. Nothing of interest stirs the Mexican Utility group.

Underground Railway stocks are dullish. The Income bonds at 100 went ex-dividend this week. Metropolitans and Districts gave way 10s. and £1 respectively. Speculative investment in this market is languid for the time being. London United Tramways debenture has fallen to 54; London and Suburban Traction preference fail to attract attention or support.

Share List of Electrical Companies.

	Nom.	Dividend. 1922.	1923.	Price Mar. 3, 1924.	Rise or fall.	Yield p.c.
Home Electricity Companies.						
Brompton Ordinary	£1	12	10	2	−3/6	*£5 0 0
Charing Cross Ordinary	£5	14	14½	14½	—	5 0 0
do. do. do. 4½ Pref.	£5	4½	—	4½	+ ¼	5 6 0
Chelsea	£1	10	12	88/9	—	5 8 2
City of London	£1	15	—	47/6	—	6 6 4
do. do. 6 % Pref.	£1	6	—	23/-	—	5 4 4
County of London	£1	10	15	2⅞	+ ⅛	6 7 0
do. do. 6 % Pref.	£1	6	—	22 6	—	5 6 8
Edmundson's Ordinary	£1	7	—	3⅜	+ ⅛	5 12 0
do. 6 % Pref	£5	6	—	4⅞	—	6 3 0
Kensington Ordinary	—	12	14	10½	—	6 13 4
London Electric	£1	10	—	5	—	6 0 0
do. do. 6 % Pref.	£5	6	—	5½	—	5 9 1
Metropolitan	£1	8½	10	1¾	—	5 14 3
do. 4½ % Pref.	£1	4½	—	17/-	—	5 6 0
Newcastle-on-Tyne Ordinary	£1	2½	6	18/9	+1/9	6 8 0
do. 5 % Pref.	£1	5	—	16/3	+9d.	6 3 1
do. 7 % Pref.	£1	7	—	23/6	+6d.	5 19 2
Notting Hill 6 % Pref.	£10	6	—	9½	—	6 6 4
North Met. Elec. 6 % Pref.	£1	6	—	22/-	—	5 9 1
Urban Ordinary	£1	—	—	17/6	—	Nil
do. 6 % Pref.	£1	5	—	17/6	—	6 17 2
St. James' and Pall Mall	£5	14½	17½	13½	—	6 9 8
South London	£1	11	15	41/3	−2/9	7 5 8
South Metropolitan Pref.	£1	7	—	24/6	—	5 14 3
Westminster Ordinary	£5	12	15	10⅝	—	6 18 0
Whitehall Elec. Invst., 7½ % Pf.	£1	7½	—	1	—	7 10 0
Home Rails.						
Central London Ord. Assented	Stock	4	—	68¾xd	—	5 16 10
Metropolitan	,,	5½	4	75½	— ½	5 4 7
do. District	,,	3	3½	55	−1	6 7 3
Underground Electric Ordinary	£10	Nil	—	3	—	Nil
do. do. "A"	£1	Nil	—	8/-	—	Nil
do. do. Income	Bonds	5	6	100xd	—	*5 0 0
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 14 9
do. Def.	,,	1½	84/6	22½	− ¼	6 13 4
Chile Telephone	£5	6	6	5⅛	—	5 8 6
Cuba Sub. Ord.	£10	7	7	7½	—	9 13 2
Eastern Extension	£10	10	10	16⅝	—	5 18 6
Eastern Tel. Ord.	Stock	10	10	168½	—	5 18 8
Globe Tel. and T. Ord.	£10	10	10	17½	—	5 16 0
do. do. Pref.	£10	6	6	10⅝	— ¼	5 1 4
Great Northern Tel.	£10	24	22	38	— ½	7 16 9
Indo-European	£5	10	7	22½	—	*5 7 8
Marconi	£1	25	15	1⅛	— ⅛	7 16 8
Oriental Telephone Ord.	£1	12	12	1⅞	—	*6 4 0
United R. Plate Tel.	£5	6	8	6⅝	—	*5 16 6
West India and Panama	£10	Nil	Nil	1/-	—	Nil
Western Telegraph	£10	10	10	16⅛	− ¼	*6 0 1
Home and Foreign Trams, &c.						
Anglo-Arg. Trams. First Pref.	£5	6½	12½	3⅞	—	8 6 0
do. do. 2nd Pref.	£5	Nil	5½	2⅛	—	10 13 4
do. do. 5% Deb.	Stock	5	5	75	+1	6 13 4
British Electric Traction Ord.	,,	4½	6	72	—	6 19 0
do. do. 6% Pref.	,,	6	6	98½	—	6 1 10
Brazil Traction	£10	Nil	4	59	+ ½	6 15 9
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	83½	−4	5 19 9
do. do. Preferred	,,	5	96/-	85½	—	*5 10 0
do. do. Deferred	,,	5	127/-	101½	:-	*6 8 0
do. do. Deb.	,,	4½	4½	70½	−1	5 11 1
Lond. & Sub. Trac. 6 % Pref.	£1	9½	5	6/6	—	7 13 10
London United Tram. Deb.	Stock	4	4	64	−1	7 8 2
Mexico Trams. 5 % Bonds	—	Nil	Nil	75	—	6 11 6
do. 6 % Bonds	—	Nil	Nil	83½	—	Nil
Mexican Light Common	£100	Nil	Nil	22½	—	Nil
do. Pref.	£100	Nil	Nil	48½	−1	Nil
do. 1st Bonds	—	Nil	5	68½	—	7 6 0
Manufacturing Companies.						
Babcock & Wilcox	£1	15	20	47/-	+1/-	*4 5 4
British Aluminium Ord.	£1	10	5	22/-	—	4 11 0
British Insulated Ord.	£1	15	15	5½	— ⅛	6 0 0
Callenders	£1	15	15	48/3	—	6 4 6
do. 6½ Pref.	£1	6½	6½	24/3	—	5 7 2
Crompton Ord.	£1	10	5	½	—	10 0 0
Edison-Swan	£/-	10	Nil	4/9	—	6 6 4
do. do. 5% Deb.	Stock	5	5	75½	—	6 12 5
Electric Construction	£1	10	10	30/-	—	6 13 4
English Electric	£1	5	5	17/6	—	5 14 3
do. do. Pref.	£1	6	6	1	—	6 0 0
Gen. Elec. Pref.	£1	6½	6½	22/6	—	5 15 7
do. Ord.	£1	10	5	20/3	—	4 19 0
Henley	£1	15	15	2⅞	—	6 3 0
do. 4½ Pref.	£5	4½	4½	4½xd	—	5 0 1
India-Rubber	£1	10	—	2	—	*6 13.
Met.-Vickers Pref.	£3	8	8	2⅞	—	5 5 0
Siemens Ord.	£1	10	10	10.9	−6d.	Nil
Telegraph Con.	£10	20	20	24	—	*5 0 0

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price Mar. 4.	Fortnight's Inc. or dec.
a Acid, Oxalic per lb.	5½d.	...
a Ammoniac, Sal per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£24	...
a Bisulphide of Carbon ,,	...	...
a Borax ,,	£25	...
a Copper Sulphate ,,	£25 10s.	...
a Potash, Chlorate per lb.	4d. to 4½d.	...
a ,, Perchlorate ,,	4½d.	...
a Shellac per cwt.	£15 15s.	...
a Sulphur, Sublimed Flowers ,,	£7 15s.	...
a ,, Roll ,,	£7 15s.	...
a Soda, Chlorate per lb.	3d.	...
a ,, Crystals per ton	£5 to £5 5s.	...
a Sodium Bichromate, casks per lb.	4½d.	...
METALS, &c.		
b Aluminium, Ingots per ton	£115 to £120	...
b ,, Wire per lb.	1/9 to 2/6*	...
b ,, Sheet ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I per ton net	£264	£9 inc.
Grade II ,, ,,	£188	£7 inc.
Grade III ,, ,,	£ 02	£6 inc.
c Brass (rolled metal 2" to 12" basis) per lb.	10½d.	½d. inc.
c ,, Tubes (solid drawn) ,,	1/0½ to 1/0½d.	...
c ,, Wire, basis ,,	10½d.	½d. inc.
c Copper Tubes (solid drawn) ,,	1/1½	½d. inc.
c ,, Bars (best selected) per ton	£100	£5 inc.
c ,, Sheet ,,	£100	£5 inc.
c ,, Rod ,,	£100	£5 inc.
d ,, (Electrolytic) Bars ,,	£74	£3 inc.
d ,, ,, Sheets ,,	£145 10s.	...
d ,, ,, Wire Rods ,,	£84	£3 inc.
d ,, ,, H.C. Wire per lb.	10⅞d.	½d. inc.
f Ebonite Rod per lb.	2/- to 3/6	...
f ,, Sheet ,,	2/- to 3/6	...
g German Silver Wire ,,	2/8	...
h Gutta-percha, fine ,,	8/6	...
h India-rubber, Para fine ,,	1/0	...
Iron Pig (Cleveland Warrants) per ton	£5 2s. to £5 2s. 6d.	...
i ,, Wire, galv. No. 8, P.O. qual. ,,	£25	...
k Lead, English Pig per ton	£39 5s.	£3 inc.
k Mercury per bot.	£9 12s. 6d. to £9 15s.	...
e Mica (in original cases) small per lb.	8d. to 8/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/5½	...
p ,, drawn bars and rods ,,	1/4	...
p ,, rolled strip & sheet ,,	1/3½	½d. inc.
p ,, wire ,,	1/4½	½d. inc.
o Platinum per oz.	£25	...
d Silicium Bronze Wire per lb.	1/0½	...
r Steel, Magnet, in bars ,,	10d.	...
n Tin, Block (English) per ton	£290 10s. to £291	£9 10s. inc.
n ,, Wire, Nos. 1 to 15 per lb.	4/2	3d. inc.

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
g James & Shakespeare.
h Edward Tull & Co.
i Bolling & Lowe.
k Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
r W. F. Dennis & Co.

Electricity Supply in Western Australia.—We have received from Mr. A. F. Williamson, M.I.E.E., electrical engineer to the Public Works Department, Perth, W.A., a printed list of the electricity supply stations of Western Australia, numbering 63. Of these undertakings 30 are supplied in bulk from the W.A. Government power station at Perth, which now contains plant of 19,500 kW, and generates at 6,000 volts, 40 cycles, 3-phase, transmitting at 20,000 V. The Perth municipality has plant of 5,000 kW rating, and, like all the other bulk consumers taking supply from the Government, distributes at 250/440 volts, 40 cycles, 3-phase. Fremantle municipality has plant of 4,000 kW, also fed from Perth. At Kalgoorlie the Light and Power Co. has steam plant of 4,250 kW, 3-phase, 40 cycles, working at 550 and 3,000 volts, and supplying consumers at 110 and 220 volts, and the municipality has steam plant of 585 kW, distributing d.c. at 220 and 440 volts. At Bunbury, Boulder, Collie, Narrogin, and Northam there are steam stations ranging from 420 to 173 kW, d.c., mostly at 220/440 V, and a few other townships have small steam installations. Suction gas is employed at 16 places, mostly of small capacity and all d.c., usually 220 V. The remainder are small oil-driven installations. The prices charged per kWh are generally of the same order as those prevailing here, or rather lower—at 20 places the "domestic" rate is 1½d.

Radium in Austria.—Radium has been discovered in Bohemia, west of Marienbad. The content of the ore on an average is 5½ per cent. uranium, or 0.0177 g. of radium per ton. The ore is thus much richer than the Joachimsthal ore, hitherto the only profitably-worked deposit in Europe, and richer than the Belgian Katanga ore, previously the ruling ore in the market. The size of the single lens is remarkable, one such, consisting of 80 tons ore, yielding 1½ g. of radium.

The Ideal Home Exhibition.

THE eighth Ideal Home Exhibition, organised by the *Daily Mail*, was opened at Olympia by H.R.H. The Duchess of York, on February 28th; it remains open until March 22nd. From the electrical point of view the show is very much the same as last year's, but the number of exhibitors of radio apparatus has diminished very considerably. The lighting was carried out with the advice of the British Thomson-Houston Co., Ltd., which also supplied "Mazda" daylight lamps and fittings for the garden section, and installed flood-lighting in connection with a riverside scene. Prince's electrical clocks, Ltd., installed a system of electric clocks throughout the exhibition. There are some 370 stands, and of these about 40 are either wholly electrical or bear articles connected with the use of electricity. The following are brief notes of such firms as exhibit electrical devices or accessories:—

British Electric Transformer Co., Ltd.

THE company shows three or four examples of its "Tricity" cookers, including a combination double-oven cooker (fig. 1), designed for the use of restaurants and similar establishments. It is constructed of sheet steel with cast-iron doors and facings. The double-walled oven is packed with slag wool. There are two ovens of identical dimensions, *viz.*, 16 in. by 16 in. by 14 in. Each of the ovens has a 2,000-W loading and a three-heat switch. In addition, the cooker is provided

Fig. 1.—A "Tricity" Double-Oven Cooker.

with a large grill and five boiling plates. The grill is loaded to 1,600 W, two of the plates to 2,400 W, and the other three to 2,700 W, making the total loading for the whole equipment 10,700 W. The cooker is 52 in. in width, 22 in. deep, and 37 in. high. The company also shows fires, irons, hotplates, toasters, and many other appliances.

Hotpoint Electric Appliance Co., Ltd.

The principal exhibit of the company is an array of "Hotpoint-Falco" cookers of various sizes for a diversity of situations. The "Hotpoint" electric washer is shown in operation. This employs the vacuum cup principle, which, it is claimed, takes out the dirt from clothes without injuring them. The machine is fitted with a wringer embodying a safety device. A number of immersion heaters are on view, as well as irons, percolators, kettles, and numerous other appliances.

Messrs. Tamplin & Makovski, Ltd.

The principal exhibits on this stand are lighting sets. One of these consists of a two-cylinder "Austin" petrol-paraffin engine coupled directly to a 100-V, 2-kW, d.c. generator. Another "Austin" set is shown equipped with a battery of cells by the Chloride Electrical Storage Co., Ltd. Several pumping sets are on view, as well as examples of the "Henley" wiring system, switches, and other fittings.

Messrs. L. G. Hawkins & Co., Ltd.

This stand bears a large amount of electric domestic apparatus. Included in this is the "Universal" vacuum cleaner, which dispenses with a brush, depending solely upon the suction. An appliance which we believe to be new to this country, an electrically-heated trouser-press, is exhibited. This is a simple device which we briefly described in our issue of January 4th. A new form of table grill is shown; this is somewhat similar in construction to the circular "Universal" grill, but it is square. "Duplex-a-Lite" fittings are shown. These are designed to eliminate the glare of electric lighting. As will be seen from fig. 2, the bottom of the fitting con-

Fig. 2.—A "Duplex-a-Lite" Fitting.

sists of a diffusing disk of special glass. A great part of the light is reflected by the upper part of the fitting to the ceiling. The company also shows irons, toasters (including the new "oven" type described in our issue of February 15th), grills, coffee pots, &c., as well as "Miller" table lamps in many beautiful designs.

Messrs. Belling & Co., Ltd.

This exhibit consists of fires alone. Many very artistic and efficient fires are shown, including an imitation coal fire.

Reliance Telephone Co., Ltd.

A number of inter-communication telephones are shown in operation on this stand, and many are fitted with laryngophone transmitters. A private automatic exchange is the principal exhibit.

Messrs. Duncan Watson & Co.

This firm shows the "Rotapex" washing machine and wringer, the wringer and cylinder being made of aluminium. In conjunction with this is a "Rotapex" ironing machine, which can be heated by either electricity or gas. Other appliances on view are the "Apex" vacuum cleaner, which depends for its effect solely upon the suction, and the "Kookrite" cooker of small dimensions, which may be operated from a lighting circuit.

Electrical Utilities, Ltd.

"Utility" toaster-fires are one of the attractions of this stand. This is a small toaster which can also be used as a radiator or a boiling ring. A light air-lagged electric oven is shown; this is provided with internal flues which are said to keep the temperature uniform throughout the oven. Current limiters, for use on supply systems employing a fixed charge arrangement, and a light-dimming adapter are also exhibited.

Messrs. Girdlestone & Co.

The most striking feature of this stand is the collection of artistic lighting fittings of many types, among which special mention may be made of the hand-painted glass shades and alabaster bowls. Numerous "Creda" domestic appliances are displayed—irons, saucepans, kettles, &c. The "Hoover" suction cleaner is also demonstrated. A 3-kW direct-coupled lighting set is another exhibit of this firm.

British Thomson-Houston Co., Ltd.

This company has a small stand on which are shown examples of lighting glassware which, it is suggested, are suitable for particular situations—kitchen, dining-room, &c. The types exhibited include the "Luxor," "Veluria," and "Trojan" patterns.

Messrs. Hewson & Lown.

This firm exhibits small lighting sets of various sizes, from a 1.5-kW Armstrong-Whitworth set, down to the "Service" plant which has an output of only 120 W. A "Bastian" geyser is also shown. This has a hard-rolled copper tank with a tinned interior fitted (in the case of the example

Fig. 3.—A "Bastian" Geyser.

exhibited) with a 300-W element constantly in circuit and an extra 300-W for raising the water to "bath" heat. The lagging is of dark-stained wood with nickelled retaining hoops. As shown in fig. 3, the geyser is fitted with an adjustable feed valve for the control of the inward flow.

Messrs. Hammond Bros. & Champness, Ltd.

Among a number of lifts shown by this company is an electrically-operated service lift, with push-button control and an indicator showing the position of the lift fitted in the same panel as the buttons. The working is effected by a .75-h.p. motor.

Messrs. Harwell, Ltd.

In addition to a large collection of small domestic appliances, this company shows an electrical dish-washer suitable for small hotels, boarding houses, &c. The "Transflector" showcase is another exhibit. This consists of a case with a mirror front which, when an electric lamp is switched on, becomes transparent, and enables the goods to be seen through it.

Astro Electric, Ltd.

This display consists of "Astro" reflectors for electric lamps and their various applications. As will perhaps be remembered from our description some time ago, this reflector, which has a silvered surface, is fitted actually upon the lamp and a considerable increase in intensity results from its use.

Messrs. John Barker & Co., Ltd.

This well-known company shows many electrical labour-saving devices, including suction cleaners, cookers, &c. Its ideal kitchen is very well arranged, two of the most prominent articles in it being a "Colebrook" water heater and a "Tricity" cooker, both of which are in constant use for demonstration purposes.

The British Horo-Electric, Ltd.

This is a very fascinating stand upon which the pendulums of about a hundred "Bulle" clocks swing in unison. The "Bulle" clock has a pendulum terminating in a solenoid which swings over a permanent bar magnet. At suitable intervals a current is passed through the solenoid, causing repulsion from the bar magnet, and thus keeping the pendulum in motion. As a measure of the time during which an ordinary dry cell will keep the clock in motion, it may be mentioned that the current taken by the solenoid is only 2.5 mA at second intervals.

Hurley Machine Co.

"Thor" washing and wringing machines are exhibited by this firm. This type of washer consists of a perforated cylinder revolving in a tank, the action being the forcing of the water through the clothes contained in the cylinder. The wringer is attached to the machine, and is arranged for locking in a number of positions. A smaller machine which is on view is the "Superior," which has an oscillating action. Ironers and vacuum cleaners are also shown.

Messrs. A. Dean & Co., Ltd.

Small lighting sets are shown by this company, plant of 1- and 1.5-kW capacity, with switchboards, being included. An "Essex" pumping set, driven by an electric motor, and a number of domestic appliances are also exhibited.

Blighty, Ltd.

A washing machine in which the water is actually boiled is the chief exhibit of this firm. The washing is done by the constant passage of boiling water through the fabric. The machine—if it can be so termed—has a galvanised-iron body, and is mounted on a tripod stand.

Electric Appliances Co., Ltd.

This stand bears examples of "Eurekaphone" broadcast receiving sets, including a four-valve set for the reception of music, &c., from all British and Continental stations. Among the accessories exhibited are "Eureka" low-frequency transformers.

Messrs. Houghtons, Ltd.

In the absence of a number of the leading makers of radio apparatus, this company exhibits sets of well-known makes, including those of the British Thomson-Houston Co., Ltd., Messrs. S. G. Brown, Ltd., the General Electric Co., Ltd., Radio Communication Co., Ltd., and the Western Electric Co., Ltd., as well as accessories by such firms as the Igranic Electric Co., Ltd., and the Dubilier Condenser Co., Ltd.

Northern Steel & Hardware Co., Ltd.

The Electrical Department of this company again exhibits the "Laundry Queen" electric washer, which employs the "dolly" action which enjoys favour in the north of England. A feature of the machine is its folding stand which provides platforms for baths or baskets, and facilitates wringing, &c. An electric ironer is also shown, as well as the "Northern" vacuum cleaner, immersion heaters, "Nalla" adjustable plugs, sockets, and adaptors, violet-ray apparatus, &c.

Delco Light Co.

The London branch of this firm showed examples of its well-known small lighting plant, which has previously been described in our pages. It is stated that over 200,000 sets are now in use.

Prince's Electrical Clocks, Ltd.

Apart from the clocks installed throughout the Exhibition, this company has a stand bearing working examples of the "Princeps" electrical clock. The chief advantage of this device is the fact that the pendulum does no work, *i.e.*, it is not mechanically connected to the "movement." The master clock transmits impulses at each second or half-minute to "slave" dials.

Other Exhibitors.

In conclusion, the following exhibitors may be mentioned:—The Mullard Radio Valve Co., Ltd. (valves and telephones); the "S.O.S." Patents Co. ("Barnes multiphones," receiving sets, &c.); Rogers Electric Sales Co. (Great Britain) (vibrators, violet-ray apparatus, bowl heaters, immersion heaters, &c.); Messrs. Beatty Bros., Ltd. ("White Cap" electric washers); Messrs. Hoover, Ltd. (suction cleaners); British Vacuum Cleaner Co., Ltd.; Messrs. Arding & Hobbs (small electrical appliances); Messrs. A. W. Gamage, Ltd. (small cookers and heaters); Electric Appliances Co., Ltd. ("Eureka" vacuum cleaners); Messrs. S. Guiterman & Co., Ltd. ("Adjustolite" lamps, "Safe-Economy" irons, &c.); Electrolux, Ltd. (vacuum cleaners); Mr. O. D. Binger (art lampshades); Electrico, Ltd. (fans, toasters, lighting fittings, bells, &c.); Mr. A. Martelli (alabaster bowls, shades, &c.); and the Rawlplug Co., Ltd.

The Electric Furnace and Sponge Iron.—"Sponge" iron is a considerable waste in the iron industry, and it has hitherto been considered an unavoidable loss. The electric furnace looks like solving the problem, however, although to produce good grey foundry iron a duplex system of melting appears to be necessary, and the cost will, perhaps, prevent its immediate adoption in this country. Theoretically, however, there does not appear to be any reason why sponge iron should not be purified and used in the same way that miscellaneous scrap metal is used by steel foundries that have installed electric furnaces. It is reported that experimental work in the production of foundry iron from sponge iron, performed by the Department of the Interior at the Seattle station of the American Bureau of Mines, has demonstrated that technically the process is a success, though large-scale tests are necessary to determine its commercial applicability. Such a process would find application in regions remote from blast furnaces, or where the establishment of blast furnaces would be impracticable. Sponge iron was melted in batch runs and continuous runs in various types of furnaces. The type of furnace found best fitted for the continuous melting of sponge iron is stated to be a deep pit furnace with a single electrode and a conducting hearth. The main results were as follows:—High recovery of iron, clean separation of the slag, obtaining metal of a high carbon content, introduction to the metal of silicon and manganese from the slag to eliminate the necessity of using ferro-alloys, and, finally, the removal of sulphur.

Imperial Wireless Telegraphy.

THE report of the Imperial Wireless Telegraphy Committee, which was appointed recently "to consider and advise on the policy to be adopted as regards the Imperial Wireless Services so as to protect and facilitate public interests," was issued to the public on Thursday last week (Cmd. 2,060; H.M. Stationery Office, price 1s. net). The committee consisted of Mr. R. Donald, LL.D. (chairman), Mr. F. J. Brown, C.B., C.B.E. (Asst. Sec. G.P.O.), Prof. W. H. Eccles, D.Sc., F.R.S., Sir D. Drummond Fraser, K.B.E., and Sir Henry H. Slesser, K.C., H.M. Solicitor-General, with Mr. W. E. Weston, of the G.P.O., as secretary.

The report states that in view of the urgency of the question the Committee concentrated attention on essential matters; a vast amount of evidence was examined and special investigations were made. An abstract of the Report follows.

Oversea Dominions and Wireless.

When it was found that the original all-Empire wireless policy would not be carried out, the chief self-governing Dominions took independent action, so that the construction of an all-Empire chain is not now possible. Australia entered into an agreement with Amalgamated Wireless (Australasia), Limited—an associated Marconi Company—to provide the main trunk stations in Australia and the United Kingdom and to arrange for the erection within two years of a station in Canada capable of communicating with Australia.

The Government of South Africa has entered into an agreement with the Marconi Company under which a National South African Company is organised which will build and operate a wireless station for communication with England and the rest of the world.

The Government of Canada has issued a licence to the Canadian Marconi Company for the erection of a high-power station at Vancouver, and another at Montreal.

The Government of India desired communication direct with England instead of having messages re-transmitted *via* Cairo, and has invited tenders for the erection of its stations from a company which must be national in character and in financial control.

It is understood that the New Zealand Government intends to erect its own wireless station.

Public Opinion in the Dominions.

The Dominion Governments regard wireless as the cheapest and quickest means of communication, and believe that it will improve Empire unity by bringing the people of the British Commonwealth closer together in good understanding and mutual friendship.

The strong demand for an urgent settlement of policy was expressed by Mr. Bruce, Prime Minister of Australia, in a statement which he made before leaving this country in January last.

Variation in British Policy.

The Government in 1911 laid down the principle that Empire wireless should be owned and operated by the State. This policy was not departed from until Mr. Bonar Law on March 5, 1923, stated in the House of Commons that it "was not considered necessary any longer to exclude private enterprise from participation in wireless telegraphy within the Empire, and that the Government was ready to issue licences for wireless stations in this country for communication with the Dominions, Colonies, and foreign countries."

Simultaneously with the Prime Minister's announcement, the Post Office began making arrangements for the erection of a new super-station equal in power to any in the world. A site was chosen near Rugby, and the work of erection was started without delay.

Negotiations with Marconi Company.

Following upon Mr. Bonar Law's declaration of this new policy the Marconi Company applied to the Postmaster-General (Sir William Joynson-Hicks) for a "general licence." On May 8th the Postmaster-General rejected the application. Negotiations continued from March, 1923, to January, 1924.

When we began our inquiry we found that the nine months' negotiations had ended in a deadlock. The Postmaster-General, in his letter of January 21st, referred to important points which had been discussed in previous correspondence but not settled, and the Marconi Company in reply introduced an issue of vital importance, as it challenged the authority of the Post Office to refuse the company a licence or to attach to that licence certain conditions. The statutory powers of the Postmaster-General appear to us to be against the contention of the Marconi Company. This interruption of negotiations is a continuation of the misfortunes which have dogged the footsteps of Empire wireless and caused the lamentable delays which have placed the Empire behind other nations in the use of wireless telegraphy as an indispensable means of communication throughout the world.

In view of the legal issue raised by the Marconi Company in its communication of January 26th, we saw no prospect of satisfactory settlement by reverting to any of the bases upon which negotiations had proceeded ineffectively for nine months.

The Case for Public Ownership.

There is only one station belonging to the Empire system in England, that at Leafield, Oxfordshire, and it is not exclusively occupied in carrying on an Empire service. It is not powerful enough to send messages with regularity and certainty to India, or Australia, or South Africa. It communicates with Cairo daily, but that is the extent of its capacity for regular service eastward. On the other hand, it carries on a successful service with Canada. A new medium-power station at Northolt, Harrow, also transmits a certain number of Press messages during the night hours to Halifax, Nova Scotia.

New Empire Stations Required.

The Rugby station as planned has 12 masts 820 feet high, with an aerial 1¼ miles long and about half a mile wide. The engineers now report that this station should be provided with 16 masts, which with other improvements will involve an additional estimated cost of £62,000.

The engineers recommend that the Leafield station should be modernised at a cost of £60,000. The masts, at present 300 ft. high, would be made 600 ft. high, and all the other necessary improvements for increased capacity would follow.

The engineers also state that a second Rugby station is necessary to cope with Dominion traffic in the immediate future. The provisional estimates for the extension of the Rugby and Leafield stations and the construction of two additional stations amount to a total of £875,000. This expenditure would provide work for many skilled workers and labourers in the steel and engineering trades.

Policy in Empire Wireless.

We see no prospect of success on the lines of the policy which have been discussed during the last nine months. We therefore recommend that the Post Office should erect, own, and operate the Empire wireless stations in England, with an alternative proposal in the case of Canada.

The service to Canada conducted by the Marconi Company from its station at Ongar, in Essex, to its station at Glace Bay, Nova Scotia, has been working now for 15 years. The Post Office is prepared to accept as a *fait accompli* the competitive service to Canada which already exists. The special treatment accorded to Canada in the past leads us to recommend a continuation of the present competitive system. If the proposal for exclusive State operation is adopted we think some consideration should be given to the Marconi Company, which has created a goodwill in the business. The company has no legal claim.

It is essential that the new stations be equipped with the latest apparatus. We are informed that the patents not already owned by the Government are, so far as the British rights are concerned, owned by the Marconi Company and two other companies.

Section 8 of the Patents and Designs Act of 1919 preserves for the Crown the right to use patented inventions and so, while providing adequate compensation to the holders of the patent, ensures that the State shall not be deprived of its legitimate right of user. In all licences granted to any private company the State should reserve to itself the right to take possession or exercise control over the working licensed stations whenever an emergency requires it.

In view of the industrial interests concerned in the equipment of wireless stations, every encouragement should be given to the manufacture in this country of the apparatus required for the transmission and reception of wireless messages, which is in the nature of a key industry.

Improved Business Organisation.

Certain changes are necessary in internal administration to cope better with these developments, and to put the business on equality with a private corporation. This means that delegation is necessary. The administrative head of the wireless and associated services should be able to act promptly in all matters of business, and the normal routine should be modified to enable this to be done.

The business organisation should be remodelled without disturbing the present system of financial control. The services of the most capable administrative engineering and executive officers in all branches should be obtained under conditions which will attract them and retain their services. The Post Office Advisory Council of business men should be consulted on the question of organisation.

Future Developments.

Given a new service, cheap, speedy, and efficient, Empire traffic will expand in all directions. The interchange of news and opinions between Great Britain and all the oversea Dominions and Colonies will, in itself, amount to many more millions of words per annum. We are informed that apart from the help to trade by speeding up and augmenting inter-Empire communications by wireless, finance and credit will also benefit. The change from long to short credit will become general when direct and continuous wireless communications are established within the Empire.

Policy with Regard to Foreign Wireless.

Provisional permits were given to the Marconi Company to start services with countries which were not already being served by the Post Office stations, subject to suitable terms being subsequently agreed to. The company has now four such services, namely, to France, Spain, Switzerland, and Austria. Among the terms provisionally agreed between the parties were provisions for expropriation and for sharing profits. The Post Office is carrying on services with Holland, Germany, Poland, Czechoslovakia, and to a less extent with other countries, by means of its stations at Northolt, Caister, and Stonehaven. The Stonehaven station should be discontinued. The traffic now carried on by Stonehaven and Caister could be diverted to the new Northolt station, near London.

The Post Office has retained, up to now, the exclusive right in the use of foreign wireless telephony, including services to Continental Europe, and also undertakes telegraphic broadcasting. Northolt station now sends daily 40 broadcast telegraphic messages containing commercial information to various agencies on the Continent. The business is growing, and promises to be a very remunerative one. The Northolt station is admirably adapted for carrying on this work.

A royalty on the company's gross receipts in respect of Anglo-Continental traffic, would be much better than an arrangement for profit-sharing, which would be complicated and likely to give rise to friction. The provisions in respect of extra-European services should be generally similar, but in this case there should be no royalty on the receipts, inasmuch as the company would here be in competition with the cable companies, who are not required to pay royalties.

The following recommendations are made:—

Empire Services.

1. That the State, through the Post Office, should own all wireless stations in Great Britain for communication with the oversea Dominions, Colonies, Protectorates, and territories.

2. That the Post Office should operate directly, under an improved business organisation, all the Empire stations in Great Britain.

3. That, as an alternative, an exception be made to the foregoing recommendations in the case of Canada, for reasons stated in the report, and that competition between the Post Office and private enterprise in the Anglo-Canadian wireless service, which exists at present, be continued, provided that, in any licence granted for the Anglo-Canadian service, public interests are safeguarded as regards conditions of working and terms of expropriation by the State.

4. That in any licence granted to a private company, the State must reserve to itself the right to take possession or exercise control over the working of the licensed stations whenever in the opinion of the Government an emergency requires it.

5. That the Leafield station should be enlarged as recommended by the Post Office wireless experts and engineers, that the new high-power station, now building at Rugby, should be extended to a sixteen-mast station, that a second new station of similar capacity be erected, and that these works should be put in hand without delay.

6. That each of the high-power stations should be of world range and equipped with the latest apparatus, so that the highest degree of efficiency can be attained.

7. That, if necessity arises, full advantage be taken of the Patents and Designs Act, 1919 (Section 8), under which the Crown can acquire the use of all patented inventions which may be useful for public utility services such as wireless.

8. That in order that State management and operation of Empire wireless may be carried out in a way to ensure the greatest efficiency, an improved business organisation should be set up by the Post Office, and that the Post Office Advisory Council of business men be consulted on this question.

9. That the present terminal wireless station near Cairo be removed from the Empire system as soon as the requirements of the Admiralty are met by other stations and the proposed new high-power stations in India, South Africa, and Australia are in operation.

10. That the expert Wireless Telegraphy Commission be requested to report on the extent, and cost, of a wireless system for the Colonies necessary to complete the Empire network of wireless communications.

Foreign Services.

11. That private enterprise be given facilities to develop wireless communication with Continental Europe, as with the rest of the world outside the British Empire, subject, in the case of Anglo-Continental services, to suitable terms being arranged for the payment of royalties or otherwise in view of the competition which must exist between wireless and State-owned cables.

12. That there should be free competition in foreign wireless, subject to the State reserving the right of expropriation and the right to take possession and assume control in case of national emergency.

13. For the present the existing provisional licences for Continental services should be renewed, and the Post Office should concentrate its Continental traffic as far as possible at Northolt; the station at Stonehaven should be discontinued without avoidable delay; and arrangements should also be made to discontinue the station at Caister as soon as other provision is made for the traffic.

14. That telegraphic and telephonic broadcasting to the Continent be carried on by the Northolt station.

A number of explanatory statements are appended to the report, constituting a handy record of the course of Government policy on Empire wireless since 1904, with notable announcements made by Ministers from time to time, resolutions passed at Imperial conferences, a brief account of the Post Office wireless activities, copies of correspondence between the Post Office and the Marconi Company, a summary of the position of wireless in the Dominions and India, summaries of the agreements between the South African and Australian Governments and the Marconi Company, an account of the Marconi Company and its associates, and a statement regarding the position of wireless telegraphy in France, Germany, Italy, and the United States. The draft agreement between the Post Office and the Marconi Company with regard to Anglo-Continental wireless is quoted in full.

According to *The Times*, it is understood that if any sections of the House of Commons desire to debate the report at once an opportunity will be afforded on the Report Stage of the Supplementary Estimates.

Spanish Electrical Progress in 1923.

The great difficulty which the large electrical undertakings have experienced in obtaining capital has caused the suspension or limitation of plans for extensions, and the postponement of many new works. Nevertheless, hopes are entertained of better times, and hydro-electric installations begun in past years have been continued, and some were actually finished and started up in the past year. The increasing call for electricity from numerous communities in various parts of the country acts, too, as a constant spur to development.

Among the installations brought into service during 1923, the leading one was that of the Hidroectrica Iberia at the Falls of Cinca in the Arragon Pyrenees from which 28,000 kW is transported to the Bilbao district (290 km.) at a pressure of 132,000 V. The second group is that of the Hidroelectrica Española (15,000 kW) at the Falls of Dos Aguas in the Jucar, the energy from which it is proposed to transport to Madrid, with which end in view the transmission lines from the Falls of Molinar and Villora have already been strengthened to cope with an increase of pressure from 70,000 to 132,000 V. The third group of installations is that of the Electricas Reunidas de Zaragoso at the Falls of Anzanigo on the Gallego River (6,000 h.p.), finished at the end of 1922, and the 4,000-h.p. plant constructed by the Sociedad Anonima Fuerzas Motrices del Valle de Lerin, the energy from which is to be tranported to Almeria. The fourth important installation is that of the Sociedad Productora de Fuerzas Motrizes, whose works are situated at the Cledes Fall on the Garona River, with an installed power equal to 16,000 h.p., in four sets of 4,000 h.p. With a number of smaller works started up during the year, the increase of hydro-electric energy amounts to a total of 80,000 h.p. in round figures.

The extension of the 298-km. Cinca line into the Bilbao district linking it with the Lafortunada (Huesca) station shows noteworthy progress, as does the use of a transmission pressure of 132,000 V, which sets Spain again in the front rank among European countries using high-voltage transmission. The Lafortunada hydro-electric station, which are already installed two big groups of 14,000 kW each, to utilise the Falls of the Cinca, are so planned as to allow of additional plant to yield upwards of 100,000 kW, contributed by the falls on the rivers Cinqueta, Barrosa and Frigonesa, the harnessing of which is now under way. The Mengemor company is constructing a 70,000-V transmission line, 100 km. in length, from Cordoba to Villanueva de las Minas (Seville), and has installed a new group of 3,500 h.p. at the Falls of El Carpio.

During the current year the harnessing of the Falls of Villalba de la Sierra (Cuenca) 15,000 h.p. on the River Jucar, by the Hidroelectrica de Castilla, will be continued, the current being transported to the Bolarque station. The enlargement by the Hidroelectrica del Cantabrico of its Somiedo station will also be completed, thus doubling its present output of 8,000 h.p., which is distributed in the Asturias. The harnessing of the Tambre Fall by the Gallega de Electricidad will also be continued in co-operation with the holder of the concessions, Don Wenceslao de Garra; the Argoné Fall (5,000 h.p.), will be harnessed by the Cataluna de Gaz y Electricidad; the Peñas de Castro Falls on the Tajo (3,000 h.p.) by the Sociedad Anonima Fabria de Ladrillos of Valderriba, ceded to its daughter company "Portland Valderribas"; the storage dam on the river Flamisell, to regulate the Pobla de Segur (Lerida) Fall, under construction by the Sociedad Productora de Fuerzas Motrizes; the Verin (Orense) Fall of the Electra de Viesgo company; and the hydro-electric works which the Cooperativa de Fluido Electrico, of Barcelona, has in hand.

Important concessions like those for the development of the Rivers Cofio and Alberche, not more than 80 km. from Madrid, which urgently needs power, are reported. Those on the river Guadalquivir between Cordoba and Seville, held by the Mengemor company, totalling 65,000 h.p., have not been com-

menced owing to the difficulty in finding the necessary capital for the execution of the work; the same remark applies to the concessions held by the Productora de Fuerzas Motrices on the Rivers Cinca and Ara, aggregating more than 150,000 h.p.

Electric traction made appreciable progress in 1923, five lines having been extended by the addition of 27 km., and one, the Tranvias de Granada, having enlarged its network to 100 km.

Among the railway lines in course of construction at the beginning of 1924, that from Madrid to Gijon, 62 km. in length, is prominent. Direct current at 3,000 volts and 270-h.p. locomotives of 78 tons weight are being employed. Other lines under construction are those of the Electra de Viesgo and the Sociedad Iberica de Construcciones Electricas. The Metropolitano Alfonso XIII opened a section in the course of the past year, and another section is under way. There are also the funicular railway being constructed by the Diputacion de Viscaya, the conversion of the Zumarraga to Zumaya railway to be carried out by the Diputacion de Guipuzcoa, and the State line Ripoli to Aix-les-Thermes.

The concessions relating to suburban railways and electric tramways applied for and granted during 1923 include the funiculars from the Planas de Vallvidriera to Rabasada and Montserrat to Callvate, the secondary railway from Sardanyola to Callvate, the suburban line from Barcelona to Badalona, various lines of tramways in Lerida and Ferrol, underground lines at Bilboa, Madrid, and Barcelona, the Gijon to Granda tramway, and sundry extensions of existing networks in Madrid and Barcelona.

For the continuation of works and installations in course of construction there has been effected, notwithstanding the existing national financial stringency, issues of bonds by 21 companies to the amount of 161,000,000 pesetas.

The Design of Apparatus for a.c. Circuit Protection.

By A. S. FITZGERALD, A.M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

No new principles or fundamentally novel circuits will be found in the paper, but the author endeavours to indicate how existing methods may be made simpler and more reliable by the use of apparatus operating on well-known principles and presenting no new features of construction, but which has not in the past been associated with protective gear. The paper is restricted to a description of differential systems of protection only, and to the class of protective gear operative on flow of current, rather than to arrangements of a preventive nature, specially suitable for supply systems operating with a neutral earthing resistance.

General agreement with the principle of instantaneously clearing earth faults of reasonably small value is assumed, as is also the necessity for protective relays being of the simplest design as well as of robust construction.

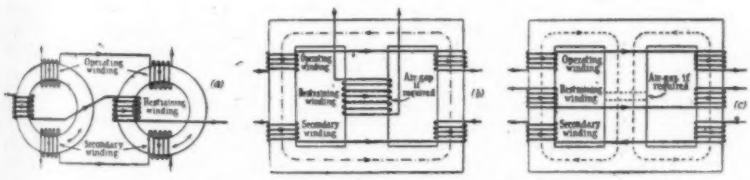


Fig. 1.—Forms of Biasing Transformer.

The author feels justified in assuming general agreement with the biasing principle, provided that the objections are avoided and the advantages retained.

A further field of application presents itself to a method of carrying into effect, by more simple means, the function hitherto performed by differential relays. A very simple method of restraining the relay from operation is provided if, instead of introducing additional forces in opposition to the operating effect, a reduction in the magnitude of the latter be brought about.

To meet this requirement the author has employed a device which, whilst its use in connection with certain special systems of control is on record, has not hitherto entered the sphere of practical engineering. In its simplest form it consists of a transformer possessing novel features. Whilst it has secondary and primary windings, it is provided with a further restraining winding in order to indicate its function. The latter is not inductively related to the operating or secondary windings, but it excites a magnetic circuit a portion of which is common to that with which the other windings are linked.

Such an arrangement might consist of a pair of ring cores as in fig. 1 (*a*), each provided with similar operating and secondary windings connected in series; a third coil present on each core (but in one case reversed in relation to the other windings) will, if excited, have the following effect: Such e.m.f.'s as may be induced in each secondary by this third coil will not appear in the complete secondary circuit, as they will be in opposition; nevertheless, the magnetic circuits of both transformers will be excited. If such proportions be chosen that currents flowing in the restraining winding give rise to saturation of the iron, this will clearly affect the secondary current corresponding to any given operating excitation, since the secondary ampere-turns will roughly be equal to the difference between the primary and magnetising ampere-turns. Excitation of the restraining winding is capable of increasing the reluctance of the magnetic circuit to such an extent as will necessitate a very much greater operating current in order to deliver the required secondary energy. If, therefore, a relay be connected to the secondary circuit of such an arrangement, and if the operating winding be connected in that portion of a protective circuit in which, according to usual practice, the protective relay would be found, exactly the features indicated are present.

Whilst the above scheme is one of the most efficient forms of restraining winding, the author employs a somewhat different method presenting peculiar advantages. A single core, having three limbs, fig. 1 (*b*), enables two magnetic circuits to exist in the one core, each of which has a common portion as specified, and coils may be arranged in various ways to have inductive relation with either of the magnetic circuits. Windings appropriate to the excitation of one or other of these magnetic circuits may, however, themselves be mutually non-inductive. The restraining winding, for instance, may consist of a single coil situated on the central limb, as in fig. 1 (*b*).

Divided operating and secondary windings will then be employed, consisting of two coils having equal numbers of turns, each being on one of the external legs of the core. This sets up a flux as indicated by the chain-dotted lines. A more efficient restraint, however, is given if divided restraining windings are employed, as shown in fig. 1 (*c*). In either case the retraining winding gives rise to a saturating flux passing through the centre, as shown by the dotted lines in fig 1 (*c*).

This form is superior since former-wound coils may be used in which laminations, conventionally jointed, may be assembled. The core is laminated in one plane only, and a further advantage is that an air-gap may be provided in the restraining magnetic circuit without reducing the unrestrained permeability of that associated with the other windings. This enables very useful restraining characteristics to be achieved.

It might be thought that this device would lead to internal balancing difficulties peculiar to its construction. However,

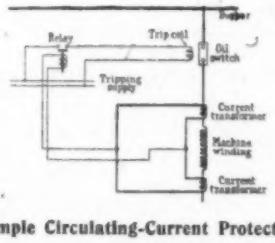


Fig. 2.—Simple Circulating-Current Protective Circuit.

it is less difficult to procure uniformity between two halves of the same set of laminations than where separate cores are involved. Even where, due to careless assembly of the core, a lack of symmetry is produced, the author's experience is that unless cores of a much larger size than those which he employs are used, the out-of-balance current in the relay when the heaviest restraining current is flowing cannot be detected by any instrument of such range as might be used to indicate the tripping current of the relay. When it is necessary to employ more than one transformer element, they will be connected in cascade. The restraining winding will be shown horizontally, the operating and secondary windings being the longer and shorter respectively of the two vertical indications. The principal functions of the biasing transformers applied

to systems of protection are as follows: (1) Overload restraint. (2) Discriminating restraint. (3) Directional discrimination. (4) Auxiliary restraint. A combination, therefore, of biasing transformers and simple electromagnetic relays may discharge the functions usually performed by balanced-beam relays, differential induction relays, or dynamometer relays in applications of the foregoing to balanced-current protection, reverse-power apparatus, and differential forms of the latter.

Fig. 2 shows what is probably the simplest form of protective circuit, *viz.*, the protection of a single winding or conductor on the circulating-current system. The two current transformers are connected so that current normally circulates between them when their primaries are carrying equivalent currents, but in the event of a fault on the winding protected —to the effect that the entering and leaving currents are no longer of equal magnitude—there will appear a difference current in the relay, this being connected between equipotential points in the circulating-current circuit. This relay will be simple, having no differential feature, and operates at a given value of difference or fault current irrespective of the "through currents." The arrangement has given entire satisfaction within its sphere of utility.

(To be concluded.)

Discussion at Newcastle-upon-Tyne.

At the North-Eastern Centre of the Institution, Mr. T. Carter presiding, Mr. A. S. FitzGerald read his paper on February 25th.

Mr. H. W. Clothier, in opening the debate, said that the operation of protective gear should be by current alone; the operation should apply to all conditions of fault.

The original matter in the paper might be summed up entirely in the method of using an auxiliary transformer for the introduction of bias, this being an alternative to biasing by relays. An alternative to bias was that known as the diverter-relay system suggested by Mr. Biles, and in course

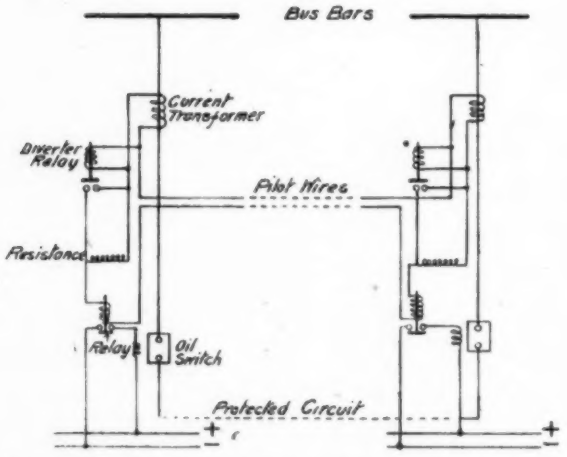


Fig. 3.—Diverter Relay applied to Merz-Price Feeder Protection.

of development by Messrs. Reyrolle (fig. 3). In the transformer and relay method of bias, the bias tended to make the relay somewhat less sensitive in its fault setting. On the other hand, the diverter relay system dealt with the problem by non-interference with the fault setting of the relay until the "straight through" current had reached a dangerous limit, at which a diverter relay operated and the operating relay was rendered insensitive to the maximum effects of the "straight through" currents, but still remained sensitive to any fault current. The ideal pilot wireless system of parallel feeder protection was a myth. The only safe treatment of it was to join the two parallel feeders together on a split-conductor system, preferably, for economy's sake, on one switch, allowing both to be tripped for a fault on one, and restoring the sound line with overload protection. The author relied for sensitiveness upon a balance of earth leakage protection. This was not accepted as a practicable solution except for generator protection. The main reason for discarding it was known to Mr. Wedmore after the proposal of his application of the idea as shown in the author's fig. 24, and another patent was taken out in an endeavour to overcome it. It was that of the experience on a large system of a fault to earth on one phase being accompanied simultaneously by a fault to earth on another phase, perhaps at another part of the system. The effect of this was to cut out the saving factor of the earthing resistance, and the fault current to earth became practically as great as the fault current between phases. Therefore, any considerations dealing with leakage protection must take into account "straight through" currents of the same magnitude as for faults between phases, and so there was no need to involve the feeder-protected circuit by a separate system dealing with the earth leakage. For practical service, transformers tested and balanced against a standard up to 10,000 amperes had sufficed to meet the ordinary demand for feeder protection with a simple relay with fault current settings of from 400 to 800 amperes when fed from one end through an earth fault. It was remarkable that the simple treatment had survived the onslaught of improvements made from time to time. The troubles with it had arisen in those cases where an endeavour had been made to cut down the operating fault current unduly. This at times had been done for no better reason than the mere saving of a few pounds in the initial cost of the earthing resistance. It might in many cases be better to earth the neutral direct and save the whole cost of the earthing resistance, than to strive for ultra-sensitiveness at the expense of stability. Those cases where a special degree of sensitiveness was required might still be dealt with by the standard form of multi-air gap transformer utilising the diverter relay method, as in this case the operating relay might be of the sensitive dynamometer type, such as the Fawssett-Parry, with inertia to avoid inadvertent operation on impulses. Two other phenomena that had been experienced on balanced protective systems which had been shown more pronouncedly on systems of 33,000 and 66,000 volts in conjunction with very large power generation, had not been mentioned by the author as a result of his investigations. One was the interference with the insulation of the pilot wire caused by the voltage induced on the pilot wire by heavy single-phase fault currents, the passage of the return of which had not been confined to the immediate surrounding of the cable. This condition might be aggravated by faulty bonding of the main cable. Inadvertent tripping of the relays would occur in the event of a pilot wire being earthed at one end, or when the insulation of the pilot wire broke down. The remedy, as proposed by Mr. Porter, had been to add "drainage coils" to the pilot wires at each end, an expedient which was found necessary for a similar phenomenon in connection with the telephone service. The other was the production of an out-of-balance current in the pilot wire due to straight through resonance currents occasioned by arcing faults to earth. In such cases there would be an actual difference of current in the two ends of the main line. For normal practical cable systems at from 6,000 to 20,000 volts the original Merz-Price protection with simple relays met all service requirements, provided unduly sensitive operation was not attempted.

Mr. R. H. Leeson said the author seemed to have advanced the biasing transformer as a sort of panacea for ills generally. The idea was certainly ingenious, and for that he deserved credit, but inasmuch as the biasing transformer did not fundamentally alter the system to which it was applied, he looked at the question not so much with regard to the biasing transformer, but rather whether it was really necessary to use it at all, and whether the present systems were benefited by it. It was not necessary in many cases; the whole question seemed to depend on the fault to earth and resistance. He deprecated the low fault setting. In the case of a fault from phase to earth the author indicated a much higher voltage—about three times—but that tended to set up faults in other places. He believed those simultaneous faults did occur. In the biasing system at the higher voltage they were more likely to get simultaneously earth faults. The author did not mention the amount of generator windings that he protected. If, for example, there was an earth resistance of 100 per cent. and a relay setting of 50 per cent., obviously 50 per cent. was, and 50 per cent. was not, protected. If the biasing transformer altered the figures, the proportion remained. Was a special conductor necessary for biasing? He questioned it, and expressed the opinion that the balancing of e.m.f. would be unsuitable on earth faults.

Mr. H. Trenchman said that the real importance of protective gear was not realised as much as it ought to be. Engineers did not give the attention to protective gearing that was given 15 years ago, but as time went on they would find that it would come into its own. More attention should be given to the testing of it; people would actually refuse to spend money for testing purposes, trusting to Providence that it would work all right. They were all striving after an ideal, and they might arrive at that state of affairs when they had only to legislate actually for faults to earth, and faults between phases would be impossible. In one case in the U.S.A. they built three separate phase houses to keep them apart. Mr. Clothier had touched upon a very interesting subject when he mentioned the new crop of difficulties which arose on the application of the discriminating system at high voltages—pilot wire systems. Directional systems and balancing between feeders he regarded at best as but makeshifts.

Mr. W. A. Burgess failed to see the simplicity of protective schemes that was claimed for them. He spoke of his own difficulty in endeavouring to protect 12 points on a large low-pressure feeder system. He tried many ways, even putting in a current transformer, but in the end he simply put in a ring main pilot and connected all the points to it, and it acted perfectly.

Mr. A. S. FitzGerald replied briefly to the discussion.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Compound-filled Box for Wiring Systems.

In the jointing of large cables in accessible positions the use of compound-filled boxes is general, but the application of this method to ordinary internal wiring systems, where the junction boxes are fitted in inaccessible, out of the way places, is not easy. Compound is usually melted and poured into the box when the joints have been made. When the box is fixed to a ceiling this becomes impossible, and, apart from this, the shrinkage which would take place upon the cooling of the compound might render the work of no value.

A system of Danish origin does away with molten compound, replacing it by a plastic substance which is far more suitable, and equally effective.

It is claimed for this compound that it contains neither acids nor alkalis; it adheres strongly to metals, porcelain,

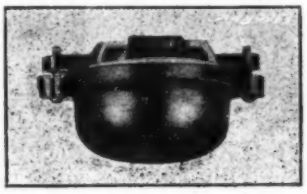


Fig. 1.—Exterior of Connector Box.

rubber, etc.; it is plastic at all temperatures, and even when cooled down to 15 deg. below zero Centigrade it shows no tendency to crack; it does not absorb water; and it possesses great dielectric strength.

The joint box employed is in two parts, between which is a solid rubber gasket. When the top part of the box has been fixed, the rubber gasket is pushed up as high as possible

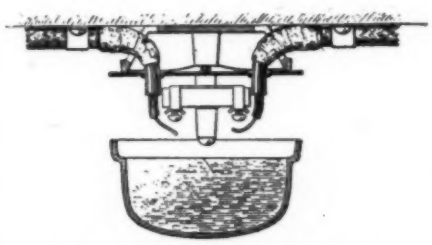


Fig. 2.—Sectional View of Connector Box.

around the cables. To facilitate this, four small holes are stamped half-way through the gasket, and for each cable a hole is made by pushing out the stamped plug. When the wires are connected up, the bottom part containing the compound is pushed up and screwed tightly to the top part. The quantity of compound in the lower part is sufficient to leave a surplus when the bottom part has been fixed; this surplus will create a high pressure inside the box so that the compound is forced into all cavities and around the cables and porcelain connector.

It will be seen from this description that absolutely watertight joints are thus obtained. Should it be necessary at any time to disconnect the box, the bottom part is easily taken off, and if it is required to clean the connector, this can be done with benzine. Figs. 1 and 2 show respectively the external appearance and a section of the box.

Messrs. S. G. Leach & Co., Ltd., 26-30, Artillery Lane, E.C.1, are the agents for this country and the colonies.

New Refractor for Street Lighting.

A new refractor, known as the "Bi-Lux" refractor, which is said to increase the effective illumination from street lighting units by approximately 70 per cent., as compared with the most efficient units now in service has been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., U.S.A., in co-operation with the Holophane Glass Company. Tests made by the Electrical Testing Laboratories of New York show that a 400-c.p. lamp within the refractor enclosed within a Westinghouse clear rectilinear glass globe will deliver 2,000 c.p. up and down the street, 425 c.p. across the roadway at right angles to the curb line, and 250 c.p. across the sidewalk. As a result of this method of "spraying" the light, the street is evenly illuminated over its entire surface, and there is no glare in the eyes of motorists or pedestrians.

Hitherto street lighting units have been designed so as to deliver the same amount of light on a horizontal plane in all directions around the unit, with the result that most of the light does not reach the surface of the road and is wasted. With the new refractor, part of the light is bent away from the sidewalk and the roadway, and is built up in the directions up and down the street between the posts where formerly dark zones existed. The refractor (fig. 3) is mounted inside the globe of the lighting unit and surrounds the lamp. It consists of two cylindrical pieces of pressed crystal glass

Fig. 3.—New Street-lighting Refractor.

nested one within the other and clamped together so as to form a single unit, the shape of which is a frustum of a hollow cone. The inside surface of the inner element and the outside surface of the outer element are smooth so that in the assembled unit the exterior surface is easily cleaned. On the outside surface of the inner element are vertical prisms which bend the intercepted light downward. On the inner surface of the outer element are horizontal prisms whose function is to bend the intercepted light into two main beams which are directed up and down the street at angles of 22.5 deg. from the kerb line. A minimum beam is deflected to strike the sidewalk at an angle of 90 deg. with the kerb line, and a beam of slightly higher intensity is directed in the opposite direction across the roadway.

A Cableway Disconnector.

Mr. George Ellison, Perry Barr, Birmingham, has supplied to colliery customers a "disconnector" for use in cableways. The appliance consists of a double-pole or triple-pole plug-switch assembled in a "straight-through" or "tee" joint box (see fig. 4). This disconnector is not new, but it is said to be more convenient than a joint box fitted

Fig. 4.—A Cableway Disconnector.

with links. The disconnector is not intended for operation when current is flowing, but to isolate sections quickly and safely for inspection, tests, and alterations. It is suitable for any class of cable, in any position, under cover or exposed to the weather; it can be inserted readily in the run of existing cables without jointing extra lengths in them, and it can

be disposed to take cables approaching from any direction. The cast-iron housing is built up in three circular sections, and a padlocked cover protects the operating handle from unauthorised persons, and an intermediate cover shields the switch. The mechanism and contacts are carried by the base casting only, alignment being independent of the relative positions of the various parts of the case. The switch contacts consist of spears of copper rod entering sockets made of phosphor-bronze spiral springs contained in cylindrically-recessed blocks. This spring plug maintains intimate elastic contact, is self-cleaning, and practically indestructible. The live parts are carried on steel rods covered with synthetic resin insulation, no fragile materials being used in the construction of the switch.

Two sizes of disconnector are standardised: to take 0.12 and 0.3 sq. in.-section cables respectively.

"Pernax" Insulation.

The Factory of the New Gutta-Percha Company.

In our issue of February 26th, 1904—almost exactly twenty years ago—we drew attention to a new insulating substance then recently introduced into England. This was originally known as "Gutta Gentzsch," but has since been renamed "Pernax." We gave a short description of the factory at Greenwich which had been erected for the manufacture of this substance by the New Gutta-Percha Co., Ltd.; we also referred to the practical trials that had been carried out by the Imperial Post Office of Germany in the manufacture of submarine telegraph and telephone cables insulated with this material, and to the more important physical and electrical properties of this material referred to in a detailed report by Mr. Ed. C. de Segundo, which were confirmed by the results of tests made by Mr. James Swinburne, Dr. Carl Otto Weber, Ph.D., of Manchester, and other experts.

During the first few years of the company's existence, progress was slow, as was only to be expected when introducing anything new—however great and however well-established its intrinsic merits—in a field already so well filled. The outbreak of war in 1914 also affected the company adversely, and many difficulties and obstacles were encountered and overcome.

However, the experience gained in the initial stages of the development of the company's business resulted in great improvements and economies being introduced in the process of manufacture of this insulating substance, and the estimation in which the company's manufactures are held in the trade is evidenced by a long list of important customers now on the books of the company which we have seen, including numerous municipal authorities, and by the numerous repeat orders received. Messrs. Stephen Glover & Co., of Newcastle-on-Tyne, wrote to the chairman, under date September 11th, 1923, to say that a well-known borough engineer in the provinces had that day told them that he had had occasion to take down some "Pernax" cable which had been in commission in an exposed place for over 15 years, and had found the insulation as good as the day when it was first erected.

We recently paid a visit to the works at Greenwich, which have been greatly extended and cover about ten times the space originally occupied; the works manager is Mr. F. C. Clarke, who has himself devised many of the machines and appliances that are installed. Whereas the company at first contemplated the manufacture of the insulating substance only, the works are now equipped with plant and machinery for the manufacture of all sizes of lighting and power cables with one, two, three or more conductors. Where more than one conductor is embodied in the cable, the cores are constructed with either circular or sector-shaped conductors. The New Gutta-Percha Company claims to be the only company that makes sector-shaped cores (for which special plant has been installed) with percha and rubber insulation; a considerable reduction in the diameter for equal insulating qualities is thereby effected, the diameter of a twin sector cable being only three-quarters of that containing twin circular cores. Other important types manufactured by the company are multi-core telephone cables and multi-core lighting cables for automatic electric signs; "interruption" cables for the Post Office; and practically every form of insulated cable or wire employed in the electro-technical industry. We are informed that the General Post Office has recently drawn up a special specification for "interruption" cables, specifying "Pernax" insulation, as the result of exhaustive trials and tests of interruption cables supplied by this company.

A feature in the manufacture of multicore cables by this company is that after the cores are laid up, the interstices are filled with "Pernax," this replacing the jute or cotton fillings commonly employed. An outer sheathing of "Pernax" is then applied. Cables which are mechanically protected by either a single or double layer of wire armour can be given a further sheathing of "Pernax" over the armour, thus preventing oxidisation of the latter. This is of great importance in the case of cables exposed to damp and to acids, &c., and we understand that large quantities of this type of cable have been supplied for colliery shaft signalling purposes. One colliery is said to be replacing the whole of its original cables with "Pernax" wires and cables of this type, as the opportunity arises. Cables sheathed with "Pernax" have also been installed in gas works, where, owing to the exposure of the cables to fumes, its advantages have been found very pronounced.

An outstanding claim for "Pernax" material is that while the initial insulation test may not exceed that of good quality v.i.r., it maintains that test because of the absence of all fillers. We are informed that a recent test of a length of bell wire of No. 18 gauge, insulated to No. 12 gauge, after soaking in water stood 3,000 volts without breaking down.

The company states that within the last few months about four miles of submarine telegraph cable, a section of which was shown to us, has been manufactured in its works at Greenwich, and has since been successfully laid in Newfoundland waters. This is particularly interesting, because it has always been claimed by the company that this material is eminently suitable for the insulation of submarine cables. The natural gutta-percha has now become so scarce that the production is said to be far from equal to the demand. We are informed that the New Gutta-Percha Company has a good deal of submarine cable work in prospect, and contemplates the establishment of a laying-up plant on the riverside near the factory. The plant appears to be exceptionally well placed for this work, because of the facilities afforded for jointing by the physical properties of the special insulating material for submarine cables. All cables and wires are subjected to the usual insulation test after the "breakdown" test at 2½ times the working pressure for 15 minutes, thus eliminating the objection to a breakdown test only.

An advantage which "Pernax" offers is that it is not vulcanised, and therefore the danger of under-vulcanisation or over-vulcanisation does not exist. This not only applies to the case where the material is used as an insulation over the conductor, but more particularly where an additional insulating sheathing is applied.

The company has also plant and equipment for the manufacture of paper-insulated and lead-sheathed cables for lighting, power, and telephone use.

It is stated that "Pernax" material is being largely used also for insulating slabs and covers; it can be easily moulded to any desired shape for pump rings, &c.

The Institution of Electrical Engineers.

North-Western Centre Annual Dinner.

The annual dinner of the North-Western Centre of the Institution of Electrical Engineers was held at the Midland Hotel, Manchester, on February 29th. Mr. G. A. Juhlin, the Chairman of the Centre, presided, and among those present were the President of the Institution, Dr. A. Russell, Mr. E. D. Simon, M.P., Mr. R. Noton Barclay, M.P., Sir Harry Haward, Sir H. Mensforth, the Mayor of Salford (Alderman McDougall), Dr. A. Ree (President of the Manchester Chamber of Commerce), Mr. C. Bentham (President, Manchester Association of Engineers), Mr. W. T. Anderson (President, Association of Mining Electrical Engineers), Alderman Walker, Mr. Bertram Thomas (Chairman, Manchester Engineers' Club), Mr. P. F. Rowell (Secretary), and others.

In proposing the toast of "The City and Trade of Manchester," Sir Philip Nash said the formation of the South-East Lancashire Electricity District and the erection of the power stations at Barton and Agecroft were examples of building for the future on broad foundations. No one engaged in the industry would dispute the wisdom of those big power stations with unified distribution. Manchester had to solve a traffic problem similar to, though not so great as, that of London, and in his opinion the solution lay in the application of electricity to the suburban railways. With regard to its use on the domestic side of life the Corporation was moving in the right direction. He was informed it was building 50 houses which were to be electrically equipped.

Dr. A. Ree, in replying, said it would be an inestimable benefit to the millions who lived in the Manchester district if the black smoke problem was solved. Experiments in the better utilisation of coal were being carried out within two miles of the city, and he thought the results would have great influence on the prosperity of the district. That prosperity also depended on the maintenance of good feeling

between the nations, and he appealed to those who could harness the forces of electricity and make them subservient to human needs to do their share in increasing international intercourse and building the bridge over which international goodwill would extend to all the peoples of the world.

Mr. E. D. SIMON, M.P., proposed the toast of the "Institution of Electrical Engineers." He said the smoke problem was not so simple as it appeared to a certain M.P. who said a Bill for the abatement of the smoke nuisance need contain only one clause, *i.e.*, that it be a criminal offence to burn raw coal.

Dr. A. RUSSELL, in responding, said that every electrical engineer was in favour of smoke abatement, and some of them hoped that it would be possible to precipitate it by electrical means and prevent the solid particles at least from issuing into the atmosphere. The membership of the Institution was now over 11,500; it was easily the largest of the engineering institutions. The College of Physicians had about 15,000 members, but then it had been in existence for over 400 years. Among the Centres the North-Western was the largest. It had more than a thousand members, and its influence was extending daily. Members could look forward hopefully to the future. The knowledge and skill of electricians was never greater than it was at present and the quality of the materials used was never higher. For this they were largely indebted to the Electrical Research Association and the British Engineering Standards Committee. This summer the Institution would entertain Colonial, American, and foreign visitors who were coming to the World Power Conference, and it would also celebrate the centenary of the birth of Lord Kelvin, the greatest of their past presidents, who was born on June 26th, 1824. As their American *confrères* did not come over until July the celebration of the centenary had been postponed until July 10th or 11th, and practically every institution in the country would join in it. It was hoped to erect later on a permanent memorial of Lord Kelvin.

The toast of "The Visitors" was proposed by the Chairman and replied to by Sir HARRY HAWARD, Vice-Chairman of the Electricity Commission, who said that some people might be disappointed with the work which the Commissioners had done, but what was their position? Look at the machinery they had to operate. There was the Act of 1882, followed by other Acts not properly brought into relation with the earlier statute. They had to test their machinery themselves, find out its weaknesses, and endeavour to tune it up. Friction arose from the conflict of personalities and vested interests. They had been accused of overstraining their powers. They were guided by the most adequate legal advice, but lawyers sometimes went wrong and in one matter they had been prohibited from going on with what seemed to be a promising scheme. During the last 30 years the advance in electrical development had been enormous; that the progress was not even quicker was due not to technical difficulties, nor to lack of money. The great difficulty in the way of reorganising the supply of electricity was created by the political and personal element and the interests which had grown up. But at all events in this time of depression the electrical industry was the one bright spot. It was moving while other industries were stagnant, and there was every prospect of further and more rapid advance in the immediate future.

Parliamentary.

[By Our Special Parliamentary Reporter.]

The Rutenberg Concession.—On February 25th, Mr. BECKER asked the Colonial Secretary if the Rutenberg concessionaires were developing the water power on the River Jordan, Palestine; was any electrical energy being produced by water power; were the internal-combustion engines still supplying the motive power; if the water power was not being developed, would he consider cancelling the concession given to Herr Rutenberg; and had he received any notification from the municipality of Jaffa protesting against the Palestine Government Order compelling it to allow the Rutenberg Co. to erect electric light standards in the streets.

Mr. THOMAS said that he understood that the works required to enable electrical energy to be obtained from the water power of the Jordan would be commenced very shortly. The answer to the third part of the question was in the affirmative, and the answer to the second, fourth, and fifth parts in the negative.

Mr. BECKER asked if the right hon. gentleman would see that pressure was brought to bear on the Rutenberg Co. to place all orders for water turbines or dynamos, which would be required, in this country.

Mr. THOMAS said that he had taken many steps to ensure the placing of orders in this country, and he intended to follow that policy, but to commit himself to that policy regardless of any other circumstances would be to expose himself to blackmail, and that he could not do.

Contracts Abroad.—On February 26th, Viscount CURZON asked the President of the Board of Trade whether he was aware that in the last eight or nine months public bodies in this country had placed orders abroad for goods to the value of nearly £1,000,000; that Bradford had given a contract to a Belgian company, whose tender was £4,000 below that of the lowest British price; that the Glasgow Tramways Committee had accepted a quotation from the United Steel Products Company for £8,568 of steel rails; that locomotives for the Indian Government and large contracts for rails, steel-tire carriages, and wagons for South Africa, and also orders for Egypt had been placed with American and German firms; that British firms were apparently undercut by at least 20 to 30 per cent. in competition with foreign firms; that the High Commissioner for Australia had just placed orders in England for over £200,000 worth of copper and bronze wire for the Commonwealth post and telegraphs departments, and at the same time stated that the wire could have been obtained for some thousands of pounds cheaper on the Continent, had it not been for the practice of Australia of giving preference to Empire products; and whether, in view of these facts, he would consent to set up a commission to report at an early date why it was possible for foreign manufacturers to undercut British industries to such an enormous extent.

Mr. WEBB replied that his attention had been drawn to some of the contracts mentioned, but he was very doubtful if a general inquiry of the kind suggested would serve a practical purpose. At no time had British manufacturers obtained all the contracts for which they had tendered, and the cases to which attention was drawn were small in comparison with the great volume of domestic and foreign trade which British manufacturers were still securing.

Bulk Generation of Power.—On February 26th, Major MOULTON asked the Minister of Transport whether he had considered the advantages to be gained from bulk generation of electrical power near the sources of coal supply and the distribution of such power over a wide area of the kingdom; and whether the Government proposed to take any action towards initiating a scheme or schemes for this purpose.

Mr. GOSLING said that, in considering technical schemes for various electricity districts, the Electricity Commissioners had the advantages referred to fully in mind, and the schemes approved by them provided for bulk generation in a limited number of well-placed stations and for the interconnection of such stations.

Electricity Authority for London.—On February 26th, Mr. P. HARRIS asked the Minister of Transport if he would state what progress had been made towards the setting up of an electricity authority for London and district, and whether he could take steps to expedite the publication of that scheme in its final form, seeing that the delay in passing a scheme was likely to prejudice the work of the new authority owing to the activities of various power companies.

Mr. GOSLING said that since July 1st last, when the decision of the Court of Appeal was given on questions arising out of the London Order, the Commissioners had been in continuous negotiation with the principal parties concerned and had revised the scheme, which they hoped to publish within the next month with a view to holding the public inquiry thereon in May.

On the motion for adjournment on February 28th, Mr. P. HARRIS called the attention of the Minister of Transport to the state of electricity supply in London. He pointed out that the members had on many occasions placed on the Table and moved resolutions with reference to electricity in several districts of England and Wales, but in London, where the problem was most important, no progress had been made. Owing to the delays the various power companies were extending their stations, and sinking large sums of money, thus prejudicing the proper solution of the problem. To get cheap and efficient electricity it was essential that there should be a supply of power for as large an area as possible. If the Minister would have the courage to insist that the Electricity Commissioners should put forward a scheme on sound lines, he would be able to give it the force almost of an Act of Parliament by administrative action. But time was vital. In London, electricity was dearer than in almost any other part of the country.

Mine Locomotive Competition.—On February 26th, Mr. SHINWELL, replying to Mr. Grenfell, with regard to the competition for the most suitable electric locomotive for mines, said that under the conditions of entry competitors were allowed until March 31st to submit their designs, and a further period of six months was allowed to competitors whose designs were selected for test to build and deliver their completed locomotives. The judging was not therefore likely to take place before the latter part of the year.

Canal Development.—On February 26th, Mr. GOSLING informed Mr. Wignall that the Government was prepared to give assistance through the Unemployment Grants Committee to practicable schemes for the improvement of canals.

Trade Facilities Bill.—During the debate on the second reading of this Bill, on February 27th, Sir PHILIP DAWSON said that the electrification of a considerable amount of the railways could be undertaken. The experience of electrification was that in every case in this country it had proved a

financial success. Comprehensive schemes of electrification needed to be placed simultaneously, instead of bit by bit, as at present and in the past. In carrying out railway electrification schemes, a very large amount of work would be put in hand for which no Government guarantees at all would be required. Large electrification schemes meant the supply of a large amount of electric power, and the contracts into which the railway companies would enter would immediately bring about the extension of large existing stations and the creation of new ones, and would do a great deal to benefit districts which to-day could not possibly expect to get large supplies of electric power at cheap rates, such as could be supplied if large power stations were erected for the purpose of supplying railways. In placing such orders, the railway companies would not only benefit our workpeople and industries all over the country, but they would bring about a very much better condition of trade, which would react upon themselves and give them increased traffic. But for amalgamation or grouping it was known that the Great Eastern Company would have electrified the whole of its system. It had plans prepared, and was ready to carry out the work. The North Eastern Company had complete schemes from York to Newcastle, and that, too, would undoubtedly have been carried out but for the grouping. They knew also that the Brighton railway intended a complete electrification of its suburban lines and a portion of its main line. All that work to-day was stopped, and very little electrification was being proceeded with.

After instancing the main-line electrification which had been carried out in America and Europe, Sir Philip said that there appeared to exist a misapprehension on the part of many people that the only main lines worth electrifying were in countries where there was no coal available, or in very mountainous countries where water power could be secured. That, he pointed out, was not in accordance with the facts. Some of the most successful main-line electrification schemes were in Germany to-day. Some of these schemes had been in operation for ten years, on from 100 to 150 miles of road in places where electricity was generated by steam. In the United States the same thing held good. Further, part of the Orleans railway was being electrified and part of the heaviest portion, just outside Paris, was going to be supplied from a big power station in Paris.

Ex-Service Trainees.—In answer to Mr. R. Morrison, who asked how many ex-Service trainees were at present employed in the electrical section of his department, Mr. Hartshorn replied that ten disabled ex-Service men trained in Government Instructional Factories were employed in the Post Office Engineering Department. In addition to these there was a total of about 15,000 ex-Service men in the Engineering Department.

Gravesend-Tilbury Tunnel.—On February 28th, Mr. Gosling informed Rear-Admiral Sueter that instructions had been given to an eminent engineer to prepare plans and reports on the suggested Gravesend-Tilbury tunnel for the consideration of the Ministry of Transport. Time was required for the study of these particulars before any decision could be reached.

Post Office Tube.—On February 28th, Mr. Hartshorn gave further details with regard to the Post Office Tube Railway. He said that the railway extended from Paddington to Whitechapel, about 6½ miles. It passed under and connected with two railway stations, Paddington and Liverpool Street, and also with six of the largest sorting offices connected with the Post Office. The object of the construction of the railway was to accelerate the distribution of mails between stations and the offices *en route*, to simplify the organisation within the sorting offices, and to secure more frequent and regular outlets. In addition, the railway would relieve the streets from much of their congestion in Central London. The Act passed in 1913 authorised an expenditure of £1,100,000. At the end of 1920 the whole of the tunnelling, and, generally speaking, the whole of the underground work, had been completed, with the exception of the permanent way, the electrical equipment, and the provision of rolling stock. Tenders at that time were invited for the electrical equipment, but the prices were so high that the work was not proceeded with. The latest estimate for completing the tube railway was £1,650,000. There had already been spent £1,135,000, which would lie idle until the scheme was completed. The railway would be worked automatically and electrically. There would be no drivers, and no persons would be employed in connection with the trains. The tunnel was nine feet in diameter. There would be a double track, on which would run steel wagons, each conveying about 10 cwt. of mails. It was estimated that something like 800 trains per day would be run at a speed of 34 miles an hour, as compared with an average of five to seven miles per hour by motor vans by road. The daily traffic dealt with would amount to 750 tons, which would represent about 60 per cent. of the total postal traffic of London.

The supplementary vote for the work was agreed to.

Private Bills.—The following private Bills have been read a second time. In the House of Commons:—The London, Midland & Scottish Railway Bill and the London County Council (General Powers) Bill. In the House of Lords:—The Chatham and District Light Railways Company Bill, the Bombay, Baroda and Central India Railway Bill, and the North Metropolitan Electric Power Supply Company Bill.

Published Specifications.

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Patent Agents.

The name of the applicant's patent agent, if any, will be found on the printed specification.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1922.

24,233. "Electrically-operated signalling apparatus specially applicable to ships' engine-room or stokehold telegraphs." J. W. Ray. September 7th, 1922. (210,811.)

27,719. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). October 12th, 1922. (Addition to 179,906). (210,826.)

30,044. "Mechanism for operating electric limit switches and the like." W. L. Wise. November 3rd, 1922. (210,836.)

30,447. "Electrical instrument for automatic detection of smoke in the atmosphere." H. Dickinson and A. M. Dickinson. November 7th, 1922. (210,860.)

30,466. "Telephone systems." Siemens & Halske Akt. Ges. January 2nd, 1922. (191,003.)

31,230. "Automatic electric circuit-breakers." J. von Clossmann and H. Halberstadt. November 15th, 1922. (210,896.)

31,482. "Ignition systems for internal-combustion engines." British Thomson-Houston Co., Ltd., and A. P. Young. November 17th, 1922. (210,901.)

31,558. "Electric couplings." W. E. Shuttleworth. November 18th, 1922. (210,903.)

31,635. "Apparatus for notching or punching core plates for dynamo-electric machines and the like." A. E. Cooper and C. Jones. November 20th, 1922. (210,905.)

32,876. "Measurement of electrical currents or potentials." Siemens and Halske Akt. Ges. December 2nd, 1921. (189,801.)

32,985. "Systems of electric ship propulsion." British Thomson-Houston Co., Ltd., and A. A. Pollock. December 2nd, 1922. (210,930.)

34,063. "Electric lamps for indirect lighting." J. C. B. Hunt. December 13th, 1922. (210,929.)

24,507. "Electric switches." British Thomson-Houston Co., Ltd., and H. C. Hastings. December 18th, 1922. (210,932.)

34,726. "Induction-starting synchronous motors." T. Yamamoto and M. Kawarada. December 20th, 1922. (210,936.)

34,826. "Rotary current motors." A. R. M. Sankey. December 21st, 1922. (Cognate application, 23,626/23.) (210,937.)

35,378. "Thermionic valve holders for wireless telegraphy apparatus." J. H. Dickson. December 29th, 1922. (210,944.)

1923.

880. "Electromagnetic apparatus for recording sound." A. F. Sykes. January 10th, 1923. (210,956.)

1,082. "Ringing and signalling apparatus for telephone systems and like purposes." Coventry Automatic Telephones, Ltd., and C. C. Puckette. January 12th, 1923. (210,960.)

1,943. "Electrical amplifying apparatus." Westinghouse Electric and Manufacturing Co. January 20th, 1922. (192,090.)

2,605. "Electric arc furnace covers." W. C. Fox. January 29th, 1923. (210,971.)

4,271. "Locking device for valves and electric switches used on motor-driven vehicles." C. E. J. Nilson. February 13th, 1923. (210,989.)

4,713. "Electrical switch mechanism." A. C. Day. February 17th, 1923. (210,997.)

5,318. "Automatic starting gear for electrically-operated fire pumps." Merryweather & Sons, Ltd., J. H. Osborne, and G. C. Cooke. February 23rd, 1923. (211,003.)

6,480. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). March 6th, 1923. (211,009.)

6,712. "Automatic telephone systems." Western Electric Co., Ltd. (G. Deakin and L. Polinkowsky). March 8th, 1923. (211,013.)

7,083. "Contacts for electric knife switches." W. J. Gibbons. March 12th, 1923. (211,016.)

7,548. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). March 15th, 1923. (211,022.)

8,063. "Discharging electrically-charged rolls or webs of paper of bag making machines." C. W. Hartmann. March 21st, 1922. (195,386.)

10,298. "Radiators for cooling liquids, particularly applicable to electric transformers." Metropolitan-Vickers Electrical Co., Ltd. April 29th, 1922. (196,912.)

11,219. "Process for heating metals or alloys in an electric furnace." Aktiebolaget Ferrolegeringar. February 14th, 1923. (211,039.)

12,046. "Wireless crystal-holders." G. Edwards. May 4th, 1922. (211,045.)

15,468. "Line contactors employed in conjunction with electrically-operated point turners, signals, and the like." S. T. Quilliam and A. T. Craston. June 14th, 1923. (211,058.)

21,174. "Wireless apparatus." L. Levy. August 24th, 1922. (202,988.)

23,916. "Wireless transmission of Morse-code signals." Soc. Française Radio Electrique. September 13th, 1922. (204,053.)

30,417. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). October 12th, 1922. (Divided application on 210,826.) (211,084.)

31,272. "Electrically-operated speedometers." A. M. Cox. November 6th, 1922. (Divided application on 210,854.) (211,086.)

Testing Bells and Relays for Use in Mines.—The Mines Department has issued a memorandum pointing out that it is willing that bells and relays intended for use underground in coal mines should be tested at its experimental station at Eskmeals, Cumberland, for the purpose of ascertaining that they comply with the conditions as to safety laid down in the report made to the Secretary of State in 1916 by Dr. R. V. Wheeler and Dr. W. M. Thornton, *viz.*: That, when in circuit with any means of supply of electric current at 25 volts pressure, bare-wire connections can be short-circuited and separated in an 8 to 8.5 per cent. methane-air mixture without causing ignition of the mixture. A fee will be charged for testing each instrument, which must, in the first instance, be submitted to H.M. Electrical Inspector of Mines for preliminary examination as regards mechanical construction and general design. One example of each bell or relay that passes the tests will be retained intact at the testing station for future reference.